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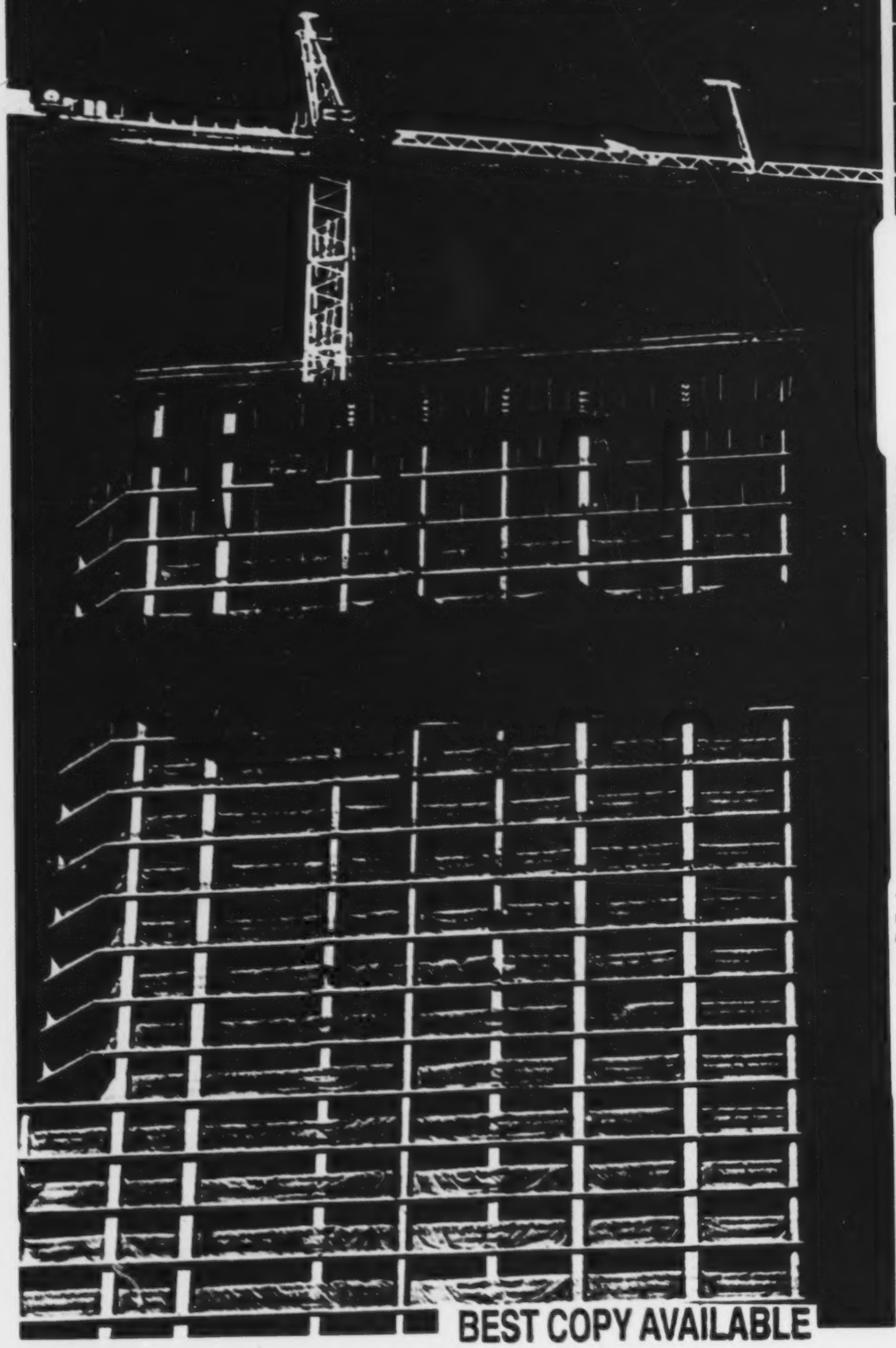
ABSTRACT

This instructor's guide contains the materials required to teach a competency-based introductory course in the fundamentals of construction to students who have chosen to explore careers in construction. The following topics are covered in the course's 10 instructional units: industry orientation (exploring the construction industry and starting a construction business); basic construction skills (construction safety, applied construction math, measuring, plan reading, site layout); and basic construction equipment (common tools and equipment, ladders and scaffolds, and rigging and material handling). Each unit contains some or all of the following: objective sheets, suggested activities, supplemental information/activities to be presented at the instructor's discretion, information sheets, sheets of supplementary information to assist students in solving problems, transparency masters, instructional supplements containing suggestions for teaching basic skills, assignment sheets, job sheets, practical tests, written tests, and answers to assignment sheets and tests. Academic skills training is combined with vocational training throughout the instructional materials, and a system of icons has been used to help instructors identify activities into which training in the following basic skill areas has been infused: reading, science, creative thinking/problem solving, writing, oral communication, employability, math, interpersonal skills, and social studies. Most units of instruction are designed for use in more than one lesson or class period of instruction. These materials precede the instructional units: information on basic skills in curriculum, information on measuring student performance gains, and required criteria for a competency-based education program. A competency profile and basic skills matrix are provided. (MN)

ED 385 680

introduction to construction series

fundamentals of construction



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FUNDAMENTALS OF CONSTRUCTION

Developed as a Cooperative Project by
the Associated General Contractors of America
William W. Brown, Chairman, Manpower and Training Committee
and
Curriculum and Instructional Materials Center,
Oklahoma Department of Vocational and Technical Education

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Fundamentals of Construction

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FOREWORD

In 1985, The Associated General Contractors of America (AGC) met with representatives of the Oklahoma Curriculum and Instructional Materials Center (CIMC) to discuss the possibilities of developing, as a cooperative project a course of instruction designed for training individuals who choose to seriously explore careers in construction.

This revised publication is the result of those original discussions and updates made through close coordination among general contractors and vocational educators. This series represents conscious effort to coordinate the practical experience of personnel in the construction industry with the best instructional methods of those in the field of vocational education.

Although this series reflects a systematic approach to instructional materials development and the latest in educational technology innovations, the information in the Fundamentals of Construction should be adapted and modified to coincide with local conditions.

Roy Peters, Jr.
State Director
Oklahoma Department of Vocational
and Technical Education

William. W. Brown, Chairman
Manpower and Training Committee
The Associated General Contractors
of America

PREFACE

Construction requires that students have many skills and related information to become productive workers in this challenging field. Workers must be better trained and equipped to find and retain meaningful employment. Not just in construction techniques, but also in subjects that are common to all areas of construction such as those in plan reading, math, and safety.

Instructional materials in this manual is written in terms of student performance, using measurable behavioral learning process. Criterion-referenced evaluation instrument provide for a uniform measurement of student progress.

The purpose of this manual is to assist instructors in all construction related areas in providing instruction throughout the industry. Any information in this manual that does not concur with the instructor's course of study should be modified to meet personal needs.

Personnel safety is of prime concern, as an instructor you are encouraged to closely observe and couch students in all safety issues. We have done much to advise students of possible dangers, but your close supervision and alertness can't be overemphasized.

Al Willey
Curriculum and Instructional
Materials Center
Oklahoma Department of Vocational
and Technical Education

ACKNOWLEDGEMENTS

Much appreciation is expressed to the many individuals who contributed their time, talents, and knowledge in the revision of this manual.

Thank you to the following ad hoc committee members, AGC staff representatives, and the staff of the Oklahoma Department of Vocational and Technical Education.

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USE OF THIS PUBLICATION
INSTRUCTIONAL UNIT

Fundamentals of Construction contains ten units. Each instructional unit includes some or all of the basic components of a unit of instruction: performance objectives, suggested activities for the instructor, extensions and options, information sheets, students supplements, transparency masters, instructional supplements, assignment sheets, job sheets, practical tests, written test, and answers to assignment sheets and written test, all of which are included in the instructor's edition. The student workbook includes the objective sheets, information sheets, student supplements, transparency masters, assignment sheets, and job sheets. Written tests may be duplicated for classroom use or *additional copies* may be purchased by calling 1-800-654-4502 or, in Oklahoma, 1-800-522-5810, ext. 589.

All of the unit components tie into measurable and observable learning outcomes. Instructors are encouraged to supplement these components with other resources in order to make them as responsive to local conditions and individual needs as possible.

Most units of instruction are designed for use in more than one lesson or class period of instruction. Careful study of each unit of instruction by the instructor will help him or her determine the following:

- Amount of material that can be covered in each class period.
- Skills that must be demonstrated.
    - Supplies and equipment needed
    - Amount of class time needed for demonstrations
    - Amount of time needed for student practice
- Supplementary materials, including print and non-print media, that must be ordered.
- Resource people who must be contacted.

Objective Sheet (White Pages)

Each unit of instruction is based on the performance needed for successful employment in an occupational area. Performance objectives are stated in two forms. The unit objectives states the overall goal of the unit. It tells what the student should be able to do and what standard will be used to see whether the student can do it. Specific objectives outline the teaching sequence of the competencies required to meet the unit objective.

The objectives should be provided for students and stressed throughout the teaching/learning process. This will help answer any questions concerning performance requirements for each instructional unit. The objectives can also help determine teaching strategies and instructional methods. Instructors should prepare for each unit by deciding how each objective could be best taught.

Instructors should feel free to modify, delete, or add objectives in order to meet the needs of the students and community. When objectives are added, the instructor should remember to supply the needed information, assignment and/or job sheets, and criterion-referenced test items.

Suggested Activities (Pink Pages) – **Instructor's Edition only**

The suggested activities page assists the instructor during the preparation stage of the teaching/learning process by providing suggestions for delivery, application, and evaluation during the instructional process. The instructor should read the suggested activities prior to introducing the unit to allow time to obtain supplemental materials, prepare audiovisual materials, and contact outside resources. Duties of the instructor will vary according to the particular unit.

References used in the development of each unit are listed in the "Suggested Resources" section, along with print and non-print media that may be used to teach the unit. These materials can be used by the instructor to supplement his or her knowledge of the subject area or to help students with particular interests or occupational objectives in the area covered.

Extensions and Options (White Pages) – **Instructor's Edition only**

Extensions and Options are supplemental material that is not testable or graded and is nice-to-know. Extensions and Options provide the instructor with additional activities, fact sheets, art, controversial items, and extra practice sheets. They may also include items for the gifted or remedial student. Extensions and Options are used at the discretion of the instructor.

Information Sheets (Green Pages)

The information sheet provides "must know" content essential for meeting the cognitive objectives stated at the beginning of each unit. It serves as an excellent guide for presenting background knowledge necessary to develop the skills specified in the unit objective.

Students should read the information sheet before it is discussed in class. Space is provided in margins for students and instructors to add notes that clarify and/or expand on the information provided.

The information sheet may include notes, cautions, or warnings. These should be discussed carefully and thoroughly. **Notes** are short verbal additions to the information sheet or procedural outline that provide nice-to-know and decision-making information. A note may tell the student what to watch for or to consider at a given step. It may explain when a step may not be applicable. Notes offer guidance that may help the student understand the process and do it more efficiently. **Cautions** are advisories that tell the student how to avoid causing minor personal injury or equipment damage. **Warnings** are advisories to the student used to avoid serious personal injury or death to the student, persons in the workplace, or users of the project or the procedure.

Student Supplement (Green Pages)

Student supplements include instructions that could be used for solving problems or reinforcing the enrichment of learning. The information presented in a student supplement may consist of tables, charts, written information, forms, or other information students will need in order to complete one or more of the assignment or job sheets. While supplements are not tested over directly, they may be used to assist in meeting the performance objectives.

Transparency Masters (White Pages) - **Instructor's Edition only**

Transparency masters provide information in a special way. The students may see as well as hear the materials being presented, thus reinforcing the learning process. Transparencies may present new information or they may reinforce information presented in the information or assignment sheets.

Transparencies should be made and placed in the notebook where they will be immediately available for use. Transparencies direct the class's attention to the topic of discussion. They should be left on the screen only when topics shown are under discussion.

Instructional Supplements (Pink Pages) — **Instructor's Edition only**

Instructional Supplements provide suggestions for teaching the basic skills included in each assignment sheet or job sheet. They are located directly in front of the components they support–assignment or job sheets–in each unit.

Assignment Sheets (Tan Pages)

Assignment sheets provide students with information and exercises that address learning levels at or above the application level of Bloom's taxonomy. Assignment sheets provide written exercises for instruction and practice of a specific objective. The introduction to the assignment sheet explains how the assignment sheet relates to the subject area and unit component for such information.

Assignment Sheet Answers (Pink Pages) – **Instructor's Edition only**

This component is designed to assist the instructor in evaluating student performance on assignment sheets.

Job Sheet (Blue Pages)

Job Sheets are another important segment of a unit of instruction. The job sheets provide a list of equipment, tools, and materials needed to complete a manipulative or psychomotor skill. They describe a step-by-step procedure to complete each task or job. Diagrams, photographs, and illustration are provided to assist students in achieving the skill.

The instructor should demonstrate the procedure outlined in each job sheet. Furthermore, the instructor needs to localize the procedure according to the equipment and supplies available in the local lab or salon situation. Job sheets also furnish potential employers with a picture of the skills being taught and the performances they might reasonably expect from a person who has had this vocational instruction.

Practical Tests (Yellow Pages) – **Instructor's Edition only**

The practical tests are designed to assist the instructor in the evaluation of the psychomotor activities (job sheets). The practical test provides instructors with a valid mechanism for determining a student's level of ability in performing the procedure stated on the job sheet. The check-off list allows instructors to evaluate a student's process performance of the task on the job sheet. The overall competency indicator allows the instructor to evaluate the end product.

Written Test (Yellow Pages) – **Instructor's Edition only**

This component provides criterion-referenced evaluation of every objective listed in the unit of instruction. If objectives have been added, deleted, or modified, appropriate changes should be made on the test.

In order to measure and document student competency gains as required by the latest Carl Perkins regulations, and as outlined in the Oklahoma-developed system of standards and measures, it is *absolutely essential* that the same test be used as a pretest and as a posttest. If you choose to use tests other than the ones included herein, be sure that the same instrument is used for each activity–pre- and post test.

A detailed explanation of the Oklahoma plan for standards and measures and the Carl Perkins requirements is included in the CIMC publication, *Measuring Learning & Competency Gain: The Pretest/Posttest Approach*. This booklet and accompanying software designed to assist in calculating and recording student gains are available to all vocational teachers through the school's vocational testing liaison.

To further assist vocational teachers, the CIMC is in the process of developing test code sheets for each written test in its more recent publications, including this one. These code sheets are explained in Section 8 of the publication mentioned above, and will greatly assist in verifying that the test is a valid instrument for measuring student learning and competency gains. As the test code sheets for programs become available, they will be forwarded to teachers of each program; further publications will include the test code sheets.

Written Test Answers (Pink Pages) – **Instructor's Edition only**

This component is designed to assist the instructor in evaluating student performance on written tests.

COMPETENCY PROFILES

A competency profile is available from CIMC Resale for each publication. Competency profiles document student performance. The profile contains a list of the specific job competencies that a student should achieve before leaving the training program.

PAGE NUMBERING

Each publication for the Curriculum and Instructional Materials Center is usually assigned a specific abbreviation. ***Fundamentals of Construction*** has not been abbreviated. Each unit will be recognized by the unit number in Arabic numerals. Each unit in the publication begins with page 1. Each page number gives the component name, book title, unit number, and page number within the unit. Since some CIMC publications are loose-leaf, this system of page numbering was recently adopted so that pages from different manuals would not get mixed up. The page number for the objective sheet in Fundamentals of Construction, which is unit 6, would look like this:

OBJECTIVE SHEET - **Fundamentals of Construction**
CIMC - B6 - 1

METHODS OF DISSEMINATING MATERIAL

For best results, provide student materials for each student. Student workbooks contain objective sheets, information sheets, supplements, transparency masters, assignment sheets, and job sheets. Pretest, practical tests, and written tests are packaged separately for students, and can be stored until needed. Students should be allowed to take their materials home at the end of the course.

TEACHING METHODS

Keeping students motivated is a challenge. Supplement the objectives by providing the "why," personal experiences, and current information. If you are going to teach the material in a group setting, prepare for the unit be deciding the best way to teach each objective and allow for student input.

If you are going to follow the plan for individualized instruction, provide opportunities that will allow each student to become involved in planning for and being responsible for his or her own education.

CORRECTIONS AND SUGGESTIONS

The Curriculum and Instructional Materials Center (CIMC) wants to provide vocational instructors and students with materials that are accurate and effective. Although the CIMC strives to maintain the highest standards of development and production, oversights occasionally do occur. If you find any errors in this or other CIMC publications, or have suggestions for improving their usefulness in vocational programs, please notify the CIMC staff. One easy way of pointing out errors is to make a photocopy of the affected page and to indicate the correction on the copy. Mail this information to the CIMC, where it will be used to correct the publication before the materials are reprinted.

To ensure that the material is updated on a timely basis, notify the CIMC of necessary corrections as soon as possible after discovering the error. Do not assume that someone else will notice the error and inform the CIMC; other users may be making the same assumption. Please send corrections and recommendations for improving this publication to the following address:

Coordinator of Development
Curriculum and Instructional Materials Center
Oklahoma Department of Vocational and
Technical Education
1500 West Seventh Avenue
Stillwater, Oklahoma 74074-4364

For a free catalog, a list of new publications, or other instructional materials information call 1-800-522-5810, extension 589.

RESALE

BASIC SKILLS IN CURRICULUM

The CIMC has always been mindful of the importance of reinforcement (and sometimes remediation) of students' academic skills as they progress through vocational training, and has always included activities in its materials to enhance and promote use of these skills.

Recent state and federal legislation mandates vigorous basic skills development in vocational education in the wake of demands by industry that workers *must* be academically, as well as technically, competent, given the nature of the highly complex work place. In response, the CIMC has taken the following steps to document that, indeed, the instructional materials *do* combine academic skills training with the vocational training. In addition, concerted efforts have been made to "beef up," or enhance the basic skills instruction already present. Following is a brief description of those processes:

Basic Skills Icons and Enablers

To assist teachers and students in identifying activities that promote basic skills development, the CIMC has implemented a marking system that uses simple graphic symbols, or icons, and a list of specific tasks, or enablers, to identify the basic skill or skills that are called for in each job or assignment sheet.

Each of the nine broad skills areas–reading, writing, mathematics, science, oral communication, interpersonal or relating, creative thinking and problem solving, employability, and social studies–is represented by the icon presented below.

Reading

Science

Creative Thinking/Problem Solving

Writing

Oral Communication

Employability

Math

Interpersonal or Relating

Social Studies

When an activity involving one of these basic skills is identified, the corresponding icon is placed in the left-hand margin of the job or assignment sheet. The basic skills training is further defined by retrieving the specific, or enabling, skill that is required by consulting a list of over two hundred and fifty enablers that has been compiled and grouped with each general basic skill. This enabling skill is placed directly below the icon.

As an example, an exercise that requires a student to conduct library research would make necessary the use of specific reading comprehension and research and reference skills. The basic skills that the exercise promotes would be depicted in the left-hand margin as follows.

Reading Comprehension

- Gain factual information

Research and Reference

- Select useful resources
- Find materials in library

[Text]

Basic Skills Documentation Matrix

Another-component of the CIMC basic skills instructional plan is the "Basic Skills Documentation Matrix." The matrix graphically summarizes the basic skills training included in the vocational program, unit by unit. It should be helpful to teachers in planning their instruction, and to administrators as documentation that basic skills **are** being addressed during the vocational training.

The matrix is currently being produced as an attractive 22" by 34" wall hanging. Two copies are included with order of a teacher's book. Matrices for future publications will be in the form of an 8" by 11" foldout included in each teacher's packet.

FOUNDATIONS FOR LIVING

READING SKIL

VOLUME II PARTS 1 & 2

UNITS OF INSTRUCTION	Reading Comprehension									Research and Reference							
	Gain factual information	Distinguish fact, opinion and inference	Recognize stereotyping and bias	Recognize propaganda	Analyze cause and effect	Draw conclusions	Make generalizations	React to written material	Apply word analysis techniques	Select useful resources	Locate resources	Find materials in library	Use standard references	Use in-book reference tools	Use audiovisual media	Use computer data base	Use magazines and newspapers
The Leader's Edge																	
Welcome to the World										●	●	●					
Keys to Success																	

Matrices have been developed for most CIMC publications. For more information on those available for other programs, call CIMC Resale, at 1-800-654-4502.

USING THE CIMC WRITTEN TESTS AS PRETEST AND POST TEST TO MEASURE STUDENT PERFORMANCE GAINS

When you examine this book, you will notice that separate written pretests are no longer included in the units of instruction. Each CIMC unit now contains only a single Written Test. This test should be used as **both** pretest and post test by giving it once before students start a unit and again when they have completed the unit.

The reason for using a single instrument as both pretest and post test is so that direct comparison of each student's competencies before and after instruction can be made accurately. This comparison enables precise calculation, documentation, and evaluation of student **performance gains**.

Accurate performance gains analysis is an important requirement of the new Carl Perkins legislation for vocational education. Teachers can make an important contribution to the performance accountability mandated by the new federal legislation by carrying out accurate performance gains analysis for their students, and making this data available to students, parents, and administrators.

This analysis is easy to do and requires only simple calculations and record keeping. Detailed information regarding performance gains analysis is contained in the CIMC publication, *Measuring Learning & Competency Gains: The Pretest/Posttest Approach*. In addition, the CIMC has developed a computer program, CARL, which will perform all necessary calculations and will print out a record form of all information required for gain score analysis. Copies of CARL and the publication are available through your local testing liaison, or through our resale unit, 1-800-654-4502, for complimentary copies of either or both.

OBJECTIVE SHEET

INDUSTRY ORIENTATION

A 1

INTRODUCTION

The construction industry offers you virtually unlimited opportunities for a rewarding career. New materials, methods, and skills help to bring about changes in construction. It is these changes that provide an interesting challenge to the construction industry and make it a vital part of the nation's economy.

UNIT OBJECTIVE

After completing this unit, the student will be able to discuss the role of the construction industry within our free-enterprise system and be able to apply for a job. The student will show this ability by completing assignment sheets and written test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to:

1. Given a list of terms associated with free enterprise, match them to their correct definitions.
2. Provided with a list of alternatives, select factors that the construction industry contributes to free enterprise.
3. Given a list of choices, pick the roles government plays in our free enterprise system.
4. Given a list of alternatives, select levels of training recommended for major construction-related careers.
5. Choose job opportunities open to skilled construction workers.
6. Select from a list, personal attributes or attitudes that an employer looks for in an employee.
7. Given options, choose the prime goal of continuous improvement programs within the construction industry.
8. Given choices, recommend the correct procedure to apply for a construction-related job.

9. Select the correct documents an applicant may need when applying for a job and state its purpose.

10. Research personal data necessary to complete employment forms and prepare for job search activities. (Assignment Sheets 1 through 8)

11. Complete a personal information sheet. (Assignment Sheet 9)

12. Write a resumé. (Assignment Sheet 10)

PREPARATION

- Review unit and plan presentation.
- Obtain materials needed to supplement unit.
- Order materials listed in suggested resources.
- Make a bulletin board display with ads and job notices for construction-related openings; also include Department of Labor or other agency forecasts for employment needs within the industry for the next few years.
- Make available books that describe various jobs in the construction trade.
- Obtain current statistics for your area or state on expenditures for construction, building permits, and so forth.
- Discuss the variety of jobs available in the construction industry, emphasizing those that require skills taught in this course.

DELIVERY

Objective 1: Given a list of terms associated with free enterprise, match them to their correct definitions.

- Discuss terms and definitions.
- Show students examples to illustrate appropriate terms.
- Use TM 1 to discuss the free enterprise system.

Objective 2: Provided with a list of alternatives, select factors that the construction industry contribute to free enterprise.

- Using the information sheets, discuss the construction industry's contributions.
- Ask students to describe other businesses supported by the construction industry.

Objective 3: Given a list of choices, pick the role government plays in our free enterprise system.

- Use the information sheets to describe the role of government.

- Research newspapers or magazines to find current examples of our government playing a role in free enterprise.

Objective 4: Given a list of alternatives, select levels of training recommended for major construction-related careers.

- Relate the levels of training to specific construction-related occupations/careers.

- Provide students with brochures and pamphlets from various types of training programs, such as those from colleges offering construction management programs.

- Invite representatives from organizations and employers involved in training to discuss their programs with the class. You may wish to take the class to some of the training programs so that students may view the training in progress.

- Explain that recommended levels of training may vary with each person, based on his abilities and background.

- Use information sheets to introduce students to the "TECH PREP" program.

Objective 5: Choose job opportunities open to skilled construction workers.

- Discuss job opportunities available in the construction industry.

- Emphasize those specialties that are prevalent in your area and those for which your program is most tailored.

- Discuss the particular skills and tasks required for the specialties in which the students are particularly interested.

- Invite workers from various skills and construction project to talk to the class about the kinds of work they do.

- Have students write a one page report on various skills that are of particular interest to them.

Objective 6: Select from a list, personal attributes or attitudes that an employer looks for in an employee.

- Discuss traits that an employer looks for in an employee.

- Emphasize that the traits listed in the information are helpful to any worker.

  EXAMPLES: A good worker should have a good set of tools and use and care for those tools properly.

  A good worker realizes that there is always more to learn and ways to improve; a good worker never tries to hide weaknesses in skills or knowledge.

  A good worker observes all safety rules, because the worker realizes that there are sound reasons for each rule.

  A good worker is interested in doing a good job and takes pride in his work.

  A good worker must be drug free in order to be productive, safe to himself and to his co-workers.

- Stress to the students that the traits listed in the information will aid them during their training in this program and in dealing with life's situations in general.

- Invite appropriate employers to the class to discuss the traits that they look for in potential employees and how they go about determining whether job applicants have those traits.

Objective 7: Given options, choose the prime goal of continuous improvement programs within the construction industry.

- Use information sheets to discuss quality initiatives.

- Show film "Striving for the Best: Implementing TQM in a Construction Company."

Objective 8: Given choices, recommend the correct procedure to apply for a construction-related job.

- Discuss procedures for applying for a job.

- Discuss what the student will need and what they should take with them when applying for a job.

- Discuss how they should dress, such as wearing work clothes that are clean and neat; point out how a clean neat person makes a good impression.

Objective 9: Select the correct documents an applicant may need when applying for a job and state its purpose.

- Discuss the hiring process and the documents that may be required in obtaining a job.

- Refer to sample of industry certifications. Student Supplement 1.

APPLICATION

Objective 10: Research personal data necessary to complete employment forms and prepare for job search activities. (Assignment Sheets 1-8)

- Use Assignment Sheets 1, 2, and 5 to reinforce proper format for letter of application, application form, and follow-up.

- Use Assignment Sheets 4 through 8 to allow students to practice completing forms. Emphasize the need for accuracy and neatness, and help students who are intimidated by forms to try to overcome any fears.

- Use Assignment Sheet 3 to allow students to practice making an interview appointment by telephone. Stress that this call is the first contact an applicant may have with the firm.

- Take students to a state or private employment agency and allow the agency staff to explain their functions and services.

- Use the films and other resources mentioned in this section to expand the information and assignment sheets.
- Repeat Assignment Sheet 4 or similar interviewing role-plays in a variety of ways to allow students to gain the most benefits.

  EXAMPLES: Videotape the interviews and allow the students to watch themselves; invite people with hiring responsibilities to act as the interviewer; allow the students to critique each other's interviews; change the questions.

- Use actual job notices and contact with actual employers to obtain the information necessary for Assignment Sheet 6; emphasize the many different factors besides salary that enter into an employment decision.

  EXAMPLES: Benefits, travel requirements, advancement opportunities, the sense of achievement, and the chance to develop new skills

- Invite recent graduates of your program to talk to the students about what they discovered upon entering the job market, about what surprised them, about how this training prepared them, and about how their attitudes may have changed since the time they first entered training.
- Review this unit at the end of the course, or when students are ready to enter on-the-job training.

Objective 11: Complete a personal information sheet. (Assignment Sheet 9)

- Use Assignment Sheet 9 to give students practice in completing a personal information sheet.

Objective 12: Write a resumé. (Assignment Sheet 10)

- Use Assignment Sheet 10 to give students practice in writing a resumé.

EVALUATION

Pretest

- Give written test as pretest.
- Determine individual study requirements from pretest results.
- Counsel students individually on pretest results and study requirements.
- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.
- Complete appropriate section of competency profiles.
- Reteach and reevaluate if necessary.
- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Give the written test.

  NOTE: The written test may be given in sections if desired.
- Complete appropriate sections of competency profiles.
- Reteach and retest if necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

AGC Resources

- *Construction: A Brochure Describing Career Opportunities for Men and Women.* AGC of America, 1957 E. Street, N.W., Washington, D.C. 20006.

- *Implementing TQM in a Construction Company.* The Associated General Contractors of America (AGC), 1957 E Street, N.W., Washington, DC 20006. (202) 393-2040.

- *Infrastructure: An American Crisis?* AGC of America, 1957 E. Street, N.W., Washington, D.C. 20006.

- *Striving for the Best: Implementing TQM in a Construction Company.* The Associated General Contractors of America (AGC), 1957 E Street, N.W., Washington, D.C. 20006. (202) 393-2040.

Electronic Media

Write or call the following companies for the most current films and/or publications or information on applying for and getting a job.

- Academic Software, 1415 Queen Ann Road, Teaneck, NJ 07666. (301) 837-8174.

- Army Reserve Recruiter, U.S. Government Printing Office. (214) 767-0451.

- Churchill films, 622 North Robertson Boulevard, Los Angeles, CA 90069. (213) 657-5110.

- Coronet Films, 65 East South Water Street, Chicago, IL 60601. (800) 621-2131.

- *Heaven Sent.* Construction Industry Workforce Foundation, 1000 Duke Street, Alexandria, VA 22314. Video.

- *Have you Got What It Takes for a Career in Construction?* Construction Industry Workforce Foundation, 1000 Duke Street, Alexandria, VA 22314. Video.

- Oklahoma Department of Vocational and Technical Education, Resource Center, 1500 West Seventh Avenue, Stillwater, OK 74074-4364, 1-800-522-5810. (Films from the Oklahoma Department are available on a free-loan basis to Oklahoma teachers only.)

Print Media

- Army Reserve Recruiter, U.S. Government Printing Office. (214) 767-0451.

- Oklahoma Department of Vocational and Technical Education, Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, OK 74074-9990. (800) 654-4502.

UNIT REFERENCES

- *Construction: Opportunities Unlimited* Associated General Contractors of America. Washington, DC

- Nelson, Frank W. *Group Instruction for Cooperative Programs.* Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center: Stillwater, OK.

- *Occupational Outlook Handbook.* Bulletin No. 1650. U.S. Department of Labor Statistics: Washington, DC

- *Small Marketers Aid No. 71. ."Checklist for Going into Business."* Small Business Administration: Washington, D.C..

- Spann, Margaret. *English II.* Revised by Teresa Eacret, et. al. Oklahoma Department of Vocational and Technical Education: Stillwater, OK. 1983.

- Willey, Al. *Fundamentals of Carpentry.* Stillwater, Oklahoma: Oklahoma Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center and the Associated General Contractors of America, 1993.

- Wyllie, Eugene D. and Roman F. Warmke. *Free Enterprise in the United States.* South-Western Publishing Company: Cincinnati, OH.

INFORMATION SHEET

INDUSTRY ORIENTATION

A 1

OBJECTIVE 1

Given a list of terms associated with free enterprise, match them to their correct definitions.

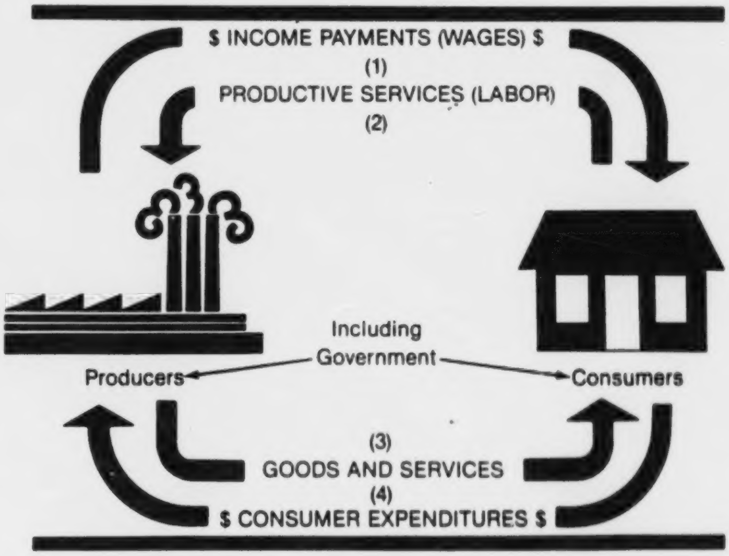
- **capital** — wealth (money or property) used or capable of being used in support of production
- **compensation** — anything given as an equivalent; payment for services
- **consumers** — those who pay to receive goods and services
- **demand** — amount of a resource, good, or service that will be bought by consumers at a specific time for a given price
- **economic value** — worth of an item in satisfying the wants and needs of producers and consumers; price or cost
- **economic system** — design, normally established by a government , to control the production, distribution, and consumption of goods and services

  EXAMPLES: Free enterprise, closed, traditional
- **enterprise** — undertaking or project; a business
- **entrepreneur** — person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit
- **flows** — exchange of goods and services for money

- **free enterprise** — term used to describe many of the economic systems used in western-style societies such as those of the United States and Canada; this system allows consumer to choose the goods and services they want or need. Producers expect an economical return and frequently charge based on the principle of supply and demand. (Figure 1)

FIGURE 1

FREE ENTERPRISE



$ INCOME PAYMENTS (WAGES) $
(1)
PRODUCTIVE SERVICES (LABOR)
(2)
Including
Government
Producers
Consumers
(3)
GOODS AND SERVICES
(4)
$ CONSUMER EXPENDITURES $

- **goods and services** — material objects and assistance provided to satisfy the wants or needs of individuals who are willing to pay to obtain them

  EXAMPLES: *Goods:* Food, clothing, housing, books, tools, lumber
  Services: Cooking, tailoring, construction, printing, tool repair, equipment rental

- **gross national product or GNP** — the total value of our nation's goods and services produced in a given year

- **labor** — physical and mental effort required to design, produce, and deliver goods and services

- **management** — person or persons tasked with coordinating resources toward making a profit

- **medium of exchange** — anything used as a measure of value in exchange for goods and services

  EXAMPLES: Currency, checks, services

- **natural resources** — land, water, fuels, and raw materials required for production

- **producers** — those who provide goods and services

- **profit** — money that a producer has left after selling goods or services and paying all expenses required in the production process

- **regulating factors** — aspects of the economic system that determine allocation, flows, and coordination

  NOTE: A regulating factor may be part of the economic philosophy of the system, such as religious beliefs in a traditional system or freedom of choice in a free-enterprise system, or the regulation may be imposed by an individual or agency, such as a government in a closed system.

- **regulation** — process of controlling, directing, or governing according to a rule, principle, or system

- **resources** — materials, facilities, planning, and organization required to produce and distribute goods and services

  NOTE: Resources are sometimes referred to as *factors of production.* Economists break resources into four categories: labor, land or natural resources, capital, and management.

- **supply and demand** — an economic principle that states that the price of goods and services is based upon the quantities available and the consumer's need or desire for that resource

- **supply** — amount of a resource, good, or service that is available for exchange at a specific time for a given price

OBJECTIVE 2

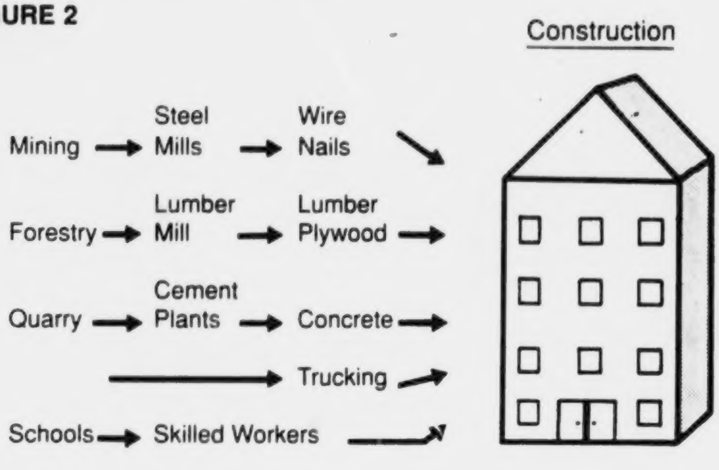
Provided with a list of alternatives, select factors that the construction industry contribute to free enterprise.

- Contributions to free enterprise

  The construction industry is the biggest industry in the United States. In 1992, the industry contributed nearly 12% of the nation's gross national product and employed nearly five million men and women.

  As an industry, it is made up of thousands of both small and large companies. Thousands of other businesses are indirectly supported by the construction industry. Consider but a few of these many businesses:

FIGURE 2


Construction
Mining
Steel Mills
Wire Nails
Forestry
Lumber Mill
Lumber Plywood
Quarry
Cement Plants
Concrete
Trucking
Schools
Skilled Workers

OBJECTIVE 3 **Given a list of choices, pick the roles government plays in our free enterprise system.**

- Role of government in a free-enterprise economy

  Everyone in a free-enterprise economy, including government, functions as both a consumer and producer. Government provides services such as postal and defense systems. It builds highways and public facilities. These activities and others require the use of resources. Additionally, government has a regulatory role in the economic system to ensure that economic goals are met and that producers and consumers can function with a degree of fairness in the marketplace.

  — Regulates use of resources

  — Legislates working conditions and wages

    EXAMPLES: Sets price for uranium ore, assists with education and training, regulates monopolies, OSHA—Job Safety

  — Provides goods and services

  — Operates social programs

  — Controls interest rates

  — Regulates international trade

  — Sets tax rates

  — Offers inducements for business expansion

  — Taxes at special rates some items considered to be luxuries

OBJECTIVE 4 **Given a list of alternatives, select levels of training recommended for major construction-related careers.**

- **academic preparations**
  - Math
  - Geometry
  - Communications
- **apprenticeship** — for many construction-related careers
  - Union, open shop
- **graduate schools** — recommended for some engineering and management positions
  - college, universities
- **post-secondary** —- recommended for most construction management careers
  - Colleges, universities, junior colleges, technical/business schools
- **preparatory training** — for all construction-related careers
  - Vocational schools, comprehensive high schools, on-the-job training
- **Tech Prep Programs**

  Tech Prep is an educational pathway that prepares students for emerging, technologically-advanced careers. With the demand for technological careers in business and industry, the bachelor's degree is no longer the *only* choice for high school graduates. Vocational-technical schools, community colleges and apprenticeship programs are among the many options available for education and training, both during and beyond high school.
- **upgrade training** — for those already employed in construction-related careers

OBJECTIVE 5 **Choose job opportunities open to skilled construction workers.**

- General construction
  - Trainees, helpers
- Construction specialists
  - Journey level worker, construction engineers, safety engineers, estimators, expediters, draftsperson, inspectors, architects, structural and utility engineer
- Construction management
  - Project manager, job superintendent, marketing manager, foreman
- General contractors
  - Building
  - Highway
  - Heavy industrial
  - Municipal/utilities
- Training
  - Apprenticeship programs, trade schools, vocational schools, colleges
- Specialty contractors
  - Drywall
  - Electrical
  - Interior
  - Masonry
  - Plumbing

  - Heating/Air conditioning
  - Sheet metal
  - Roofing
- Types of businesses
  - Lumber, concrete, brick, metal, and insulation industries
  - Prefabrication shops
  - Remodeling, restoration, and maintenance
  - Cabinet and furniture shops
  - Mobile home construction
  - Building materials, tools and equipment, sales and service
  - Equipment leasing

OBJECTIVE 6 **Select from a list, personal attributes or attitudes that an employer looks for in an employee.**

- Enthusiasm and interest
- Safety consciousness
- Dedication and dependability
- Alertness, quickness of mind
- Honesty and integrity
- Desire to work
- Knowledge of and pride in the trade
- Ability to work as a team member

- Desire to improve oneself
- Pride of accomplishment
- Desire to provide customers with continuous improvements in quality products and services
- Physical capabilities to meet requirements of the career.

OBJECTIVE 7

Given options, choose the prime goal of continuous improvement programs within the construction industry.

The construction industry has always had a goal to provide quality products and services to its customers. This quality initiative has a prime goal for constant improvement in every phase of the industry. Many companies are implementing a quality program called "Total Quality Management" (TQM).

TQM programs emphasize the need to continually monitor how well your products and services meet the needs of your customer. Customers expect more than competitive bids or well-built homes, they expect all aspects of your business to be professional. Well written contracts, accurate blueprints, and well trained craftspersons are examples of TQM initiatives.

OBJECTIVE 8

Given choices, recommend the correct procedure to apply for a construction-related job.

- Call employer's office to inquire about hiring procedures (who and where to apply).
- Be prepared to take a drug test and/or physical exam.
- Be prepared to fill out documents such as job application, W-4 Form, and Form I-9.
- Bring resumé.
- Be familiar with local labor agreements.
- Have dependable transportation.

- Wear proper work clothes (hard hat, safety shoes, etc.).
- Have tools in possession.
- Be prepared to go to work immediately.
- Some companies allow job site visits to seek employment. Be prepared to give a concise overview of your experience and references. Conditions change each day; keep trying.

OBJECTIVE 9 **Select the correct documents an applicant may need when applying for a job and state its purpose.**

- Resumé

  A resumé is a brief summary of one's qualifications and work-related experiences.

- Letter of application

  A letter of application states the applicant's interest in the position and shows the employer how the applicant will be useful to the business. A letter of application usually includes a copy of the resumé.

- Job application

  A job application is an employer's form on which the applicant provides specific information about his or her personal history, job history, job experience, education, and references.

- Follow-up letter

  A follow-up letter mailed after the interview to thank the interviewer for the interview and to refresh the interviewer's memory.

- Driver's license

  Verification of identify, legal authority to drive

- Social security card (original, not a photo-copy)

  Salary/tax reporting

- Birth certificate (may not be required by most employees)

  Proof of citizenship

- Government issued ID card

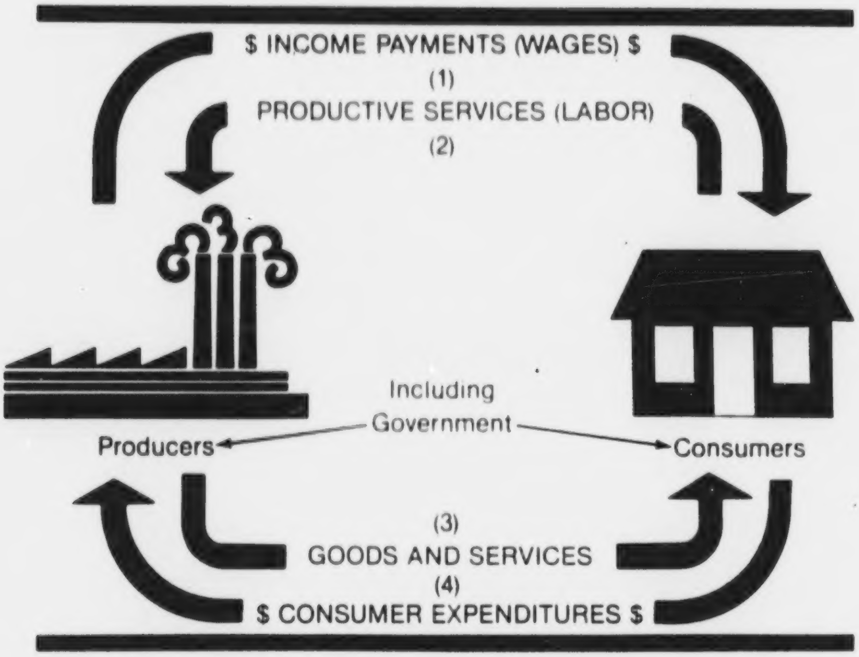
- Green card

  Legal authority for employment

- Industry certifications

  See Student Supplement 1

Free-Enterprise Flow Chart


$ INCOME PAYMENTS (WAGES) $
(1)
PRODUCTIVE SERVICES (LABOR)
(2)
Including
Government
Producers
Consumers
(3)
GOODS AND SERVICES
(4)
$ CONSUMER EXPENDITURES $

EXPLANATION

1. How production is shared — payment for resources (both labor and materials) according to how they satisfy consumer wants
2. How to produce — the use of productive services (land, labor, capital, and management) in a production process to satisfy wants
3. How much to produce — amount of goods and services produced as determined by consumer spending
4. What to produce — the demand for goods and services as expressed by consumer spending

Adapted with permission of the South-Western Publishing Company, Cincinnati, Ohio, from *Free Enterprise in the United States*, by Eugene D. Wyllie and Roman F. Warmke, 1980.

AGC Craftsworker CERTIFICATION PROGRAM

The Associated General Contractors of America is dedicated to providing programs that promote high standards in the construction industry. The AGC has designed this certification program to give prestige and recognition to individuals working in the industry. AGC Craftsworker Certification is earned by demonstrating relevant skills and knowledge needed to pass a written test and verification of education or work experience as a carpenter or bricklayer. To the contractor, the program is an impartial measure of assurance that you are competent in one or more specialized areas.

The AGC does not issue a license. Licensing is considered mandatory. The AGC Certification Program is voluntary. The program is based on challenging tests of technical skills and industry knowledge , work experience, or education. If you qualify and pass one or more of the certification tests, you will receive AGC Certification. By passing all the tests in your craft, you can achieve peer and professional status as a Certified Master Craftsworker. AGC will award all successful applicants with a hard hat decal. This seal identifies the wearer as an exceptional, motivated, safety conscious, productive professional. Also, each certified craftsworker receives a pocket card and wall certificate identifying the specific area of specialization. The employing contractors may also display signs indicating employment of AGC Certified Craftsworkers. (Signs are available on request.)

(For additional information and a Certification Application Booklet, call (405) 743-5110.

Sample Registration Form

Deadline Return AGC Certification Application by March 15

READ THE BOOKLET FIRST. Print information neatly with black or blue ink. If extra copies are needed, both sides of this form may be reproduced. Please refer to the section in this booklet "How To Fill Out The Registration Form."

1. **NAME**

______________________, ______________________, __________
Last Name First Name Middle Initial

2. **SOCIAL SECURITY NUMBER** ___ ___ ___-___ ___-___ ___ ___ ___

3. **TELEPHONE NUMBER (Daytime)** (___ ___ ___) ___ ___ ___-___ ___ ___ ___

4. **MAILING ADDRESS** ____
Street

______________________, ____________, ____________
City State Zip

5. **DATE OF BIRTH**

Month ___ ___ Day ___ ___ Year ___ ___

6. **GENDER** (Check one)

_____ (1) Female
_____ (2) Male

7. **RACE OR ETHNIC GROUP**
(Check one — Not required to answer)

_____ (1) American Indian
_____ (2) Black
_____ (3) Caucasian/White
_____ (4) Hispanic/Mexican
_____ (5) Oriental/Asian
_____ (6) Puerto Rican
_____ (7) Other ____________________
(Specify)

8. **EDUCATION** (Check the highest level completed)

_____ (1) Grade school
_____ (2) Some high school
_____ (3) Completed high school or GED
_____ (4) Post-high school vocational or technical training
_____ (5) Partial college or associate's degree
_____ (6) Completed college (B.S., B.A.)
_____ (7) Master's degree
_____ (8) Ph.D., M.D., or other professional degree

9. **REGISTRATION:** I have previously registered for an AGC Certification Test

_____ Yes
_____ No

10. **RELEASE OF INFORMATION**

_____ YES. I agree to have my test results released to my current employer.
_____ NO. I do not want my test results released.

11. **TEST CENTER**

______________ Center Number
______________ City
______________ State

12. **TESTS** (Check the one(s) you plan to take; you may only take three)

Residential Carpentry
_____ (1) Residential Form Carpenter
_____ (2) Residential Frame Carpenter
_____ (3) Residential Finish Carpenter

Commercial Carpentry
_____ (4) Commercial Form Carpenter
_____ (5) Commercial Frame Carpenter
_____ (6) Commercial Finish Carpenter

Brick/Stone Masonry
_____ (7) Bricklayer
_____ (8) Stonemason

13. **FEES**

Make check/money order payable to AGC.
Number of tests marked above

_____ × $10 = $_____
Registration Fee = + $10.00
TOTAL FEES = $_____

Fee is paid by (check one)

_____ (1) Employer
_____ (2) Craftsworker

14. **EMPLOYER** (Check the one that best describes your current employer)

_____ (1) General contractor
_____ (2) Subcontractor
_____ (3) Government
_____ (4) Military
_____ (5) Other ____________________
(Specify)

15. **EXPERIENCE**

_____ YES. I certify that I have two years of full-time experience (or equivalent) in the area of
_____ Carpentry
_____ Brick/Stone Masonry
_____ NO. I do not yet have the required experience as of this date.

16. **QUALIFICATIONS:** Complete **one** of the following sections (A, B, or C) which qualifies you to take the test(s) you are registering for.

QUALIFICATION A. Two years' experience in the field for which you are testing:

1. Current Employer ____
   From Month ____ Year ____ To Month ____ Year ____
   Address ____
   City ____ State ____ Zip ____
   Telephone Number ( ) ____
2. Previous Employer ____
   From Month ____ Year ____ To Month ____ Year ____
   Address ____
   City ____ State ____ Zip ____
   Telephone Number ( ) ____

   I certify that I have two years of full-time experience in the area of:

   ____ Carpentry
   ____ Brick/Stone Masonry

QUALIFICATION B. Graduate from a two-year vocational education program with one year of experience.

1. School ____
   Program ____ Instructor ____
   From Month ____ Year ____ To Month ____ Year ____
   Address ____
   City ____ State ____ Zip ____
   Telephone Number ( ) ____
2. To document one year of experience:

   Employer ____
   From Month ____ Year ____ To Month ____ Year ____
   Address ____
   City ____ State ____ Zip ____
   Telephone Number ( ) ____

QUALIFICATION C. Graduate of:

____ Registered apprenticeship program
____ AGC recognized vocational education program
____ Unilateral program

Program Name ____
Instructor ____
From Month ____ Year ____ To Month ____ Year ____
Address ____
City ____ State ____ Zip ____
Telephone Number ( ) ____

17. **AUTHORIZATION:** By signing and sending this form, I accept the terms set forth in the registration booklet about the tests and reporting of scores.

Signature ____ Date ____

MAIL this form and your check or money order for the total fee to :

Manpower and Training Services
The Associated General Contractors of America
1957 E Street, NW
Washington, DC 20006

AGC CERTIFICATION TESTS/OFFICE USE ONLY

____ Application Complete ____ date
____ Application Incomplete
____ Approved
____ Applicant Notified ____ date

ASSIGNMENT SHEET 1

Name ____________________ Score ________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

INTRODUCTION

The application letter is a sales technique to tell the employer how your abilities will be useful to the business. While the resumé gives general background information, the letter of application should specify your qualifications. Not all jobs require formal applications and interviews, but there are an increasing number of companies using these hiring techniques.

INSTRUCTIONS

Cut a help wanted ad for a construction job from the classified ad section of the local newspaper. Write an application letter to accompany the resumé you will prepare in Assignment Sheet 10. Use as guides the following information and the sample letter at the end of this assignment sheet.

GUIDELINES

NOTE: If you cannot type, write or print neatly, using blue or black ink.

1. Use acceptable form and appearance.
    - Type or write neatly.
    - Write on only one side of the paper.
    - Avoid smudges and typographical errors.
    - Use 8½-by-11-inch wide white bond paper, not personal or fancy paper.
    - Spell, capitalize, and punctuate correctly.
    - Include employer's full name, title, and address.
    - Include your full name and address with ZIP code.
    - Retain a copy for further reference.

Language Skills
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition Skills
- Use complete sentences
- Use introductory/closing paragraphs
- Proofread and edit

Functional Writing Skills
- Write letters

Job Search/ Selection Skills
- Locate appropriate jobs

Job Acquisition/ Development Skills
- Write a letter of application

2. Include proper information.

   - Write to a specific person.

     NOTE: Find out the name and the correct title of the person with hiring responsibility for the job that interests you. When in doubt, write to the top person who will refer your resumé to the right party. Use "To Whom It May Concern" if answering a blind ad.

   - Avoid excessive use of the pronoun "I."
   - Be brief.

     EXAMPLES: Do not repeat all information that is in the resumé.

     Avoid needless details.

     Cover all points requested in the advertisement in exactly the order in which they were asked.

     NOTE: Some prospective employers make it a point of testing the applicant's ability to follow directions.

   - State the position for which you are applying.
   - State the reason(s) for your interest in the job.

     NOTE: Employers look for people who want future advancement opportunities rather than just a paycheck.

   - Refer briefly to the main points in the attached resumé.
   - Request an interview at the employer's convenience.
   - Tell where you can be reached.
   - Say that you will telephone next week.

3. End the letter properly.

   NOTE: "Sincerely" or "Very truly yours" is appropriate.

4. Use your permanent address for the return address.

5. Staple the letter to the resumé; they may be circulated to several departments and could become separated.

6. A week later, follow up and telephone for an appointment.

   NOTE: Do not be surprised if your resumé has been referred to another department. Remember, the company is in business, and you may not get immediate attention. Be persistent until you reach the right person, and then ask for a convenient date to set up an interview.

7. Keep in touch regarding possible openings now and in the future. Keep your personal information current, such as your address/phone number.

   NOTE: The job hunt may take several weeks or even months. It is important to keep your prospects active *without being a nuisance.*

Sample letter of application

774 East Adams Street
Anytown, Your state 77704
September 3, 199-

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Progressville, Your State 77802

Dear Mr. Jones:

Please consider me for the job of rough framing carpenter that you advertised in the *Daily Chronicle*.

The skills I have learned in my high school vocational carpentry courses qualify me for this job. I have had experience in all of the basic skills required in residential construction, including the safe use of power tools.

I graduated from high school in August, and I would like to become a carpenter. A more complete description of my qualifications is given in the enclosed resumé.

I would appreciate the opportunity to come and talk over this job opportunity. I can be reached by telephone at 999-999-9999 after 3:30 or at the above address.

Sincerely yours,

Terry McKracken

Enclosure

ASSIGNMENT SHEET 2 INDUSTRY ORIENTATION A 1

Name ______________________ Score __________

OBJECTIVE 10 **Research personal data necessary to complete employment forms and prepare for job search activities.**

INTRODUCTION This employment application will give you the opportunity to see what an application looks like and give you a chance to fill one out before you actually apply for a position.

INSTRUCTIONS Complete the following application form, using the guidelines below and information about yourself from your resumé.

NOTE: Although each business uses its own form, general rules of preparation apply to any form.

GUIDELINES

1. Be prepared.
    - Take a good ink pen.
    - Take copies of resumé.
2. Look over the entire form before starting to write; do not hurry.
3. Follow directions.
    - Note whether information is to be printed or written.
    - Carry out all directions.
4. Write clearly, neatly, and legibly.
5. Answer briefly.
6. Be honest.

Functional Reading Skills
- Follow written instructions

Language Skills
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Functional Writing Skills
- Write job applications

Job Search/ Selection Skills
- Investigate employment prospects of a career field/occupation

Job Acquisition/ Development Skills
- Complete job-related applications

7. Answer all questions.

   NOTE: If questions do not apply to you, write "Not Applicable" or "N/A" in the space to show that you did not overlook the question.

8. Include complete information.

9. Recheck application when finished.

10. Avoid crossing out and erasing.

11. Use the word "open" for question about minimum salary because most employers pay standardized rates and will not negotiate on salary.

"WE ARE AN EQUAL OPPORTUNITY EMPLOYMENT COMPANY. WE ARE DEDICATED TO A POLICY OF NON-DISCRIMINATION IN EMPLOYMENT ON ANY BASIS INCLUDING RACE, CREED, COLOR, AGE, SEX, RELIGION OR NATIONAL ORIGIN OR PHYSICAL DEFECTS."

APPLICATION FOR EMPLOYMENT

PERSONAL INFORMATION

DATE

NAME — LAST — FIRST — MIDDLE

PRESENT ADDRESS — STREET — CITY — STATE — ZIP

PERMANENT ADDRESS — STREET — CITY — STATE — ZIP

PHONE NO — SOCIAL SECURITY NUMBER

REFERRED BY

LAST

FIRST

MIDDLE

EMPLOYMENT DESIRED

POSITION — DATE YOU CAN START — SALARY DESIRED

ARE YOU EMPLOYED NOW? — IF SO MAY WE INQUIRE OF YOUR PRESENT EMPLOYER

EVER APPLIED TO THIS COMPANY BEFORE? — WHERE — WHEN

EDUCATION	NAME AND LOCATION OF SCHOOL	YEARS ATTENDED	DATE GRADUATED	SUBJECTS STUDIED
GRAMMAR SCHOOL				
HIGH SCHOOL				
COLLEGE				
TRADE, BUSINESS, OR CORRESPONDENCE SCHOOL				

SUBJECTS OF SPECIAL STUDY OR RESEARCH WORK

U.S. MILITARY OR NAVAL SERVICE — RANK — PRESENT MEMBERSHIP IN NATIONAL GUARD OR RESERVES

ACTIVITIES OTHER THAN RELIGIOUS (CIVIC, ATHLETIC, FRATERNAL, ETC.)

Exclude organizations, the name or character of which indicates the race, creed, color, or national origin of its members.

(CONTINUED ON OTHER SIDE)

FORMER EMPLOYERS (LIST BELOW LAST FOUR EMPLOYERS STARTING WITH LAST ONE FIRST.)

DATE MONTH & YEAR	NAME AND ADDRESS OF EMPLOYER	SALARY	POSITION	REASON FOR LEAVING
FROM				
TO				
FROM				
TO				
FROM				
TO				
FROM				
TO				

REFERENCES: Give below the names of two persons not related to you, whom you have known at least one year.

	NAME	ADDRESS	BUSINESS	YEARS ACQUAINTED
1				
2				

IN CASE OF EMERGENCY NOTIFY

NAME ADDRESS PHONE NO

I AUTHORIZE INVESTIGATION OF ALL STATEMENTS CONTAINED IN THIS APPLICATION. I UNDERSTAND THAT MISREPRESENTATION OR OMISSION OF FACTS CALLED FOR IS CAUSE FOR DISMISSAL. FURTHER, I UNDERSTAND AND AGREE THAT MY EMPLOYMENT IS FOR NO DEFINITE PERIOD AND MAY, REGARDLESS OF THE DATE OF PAYMENT OF MY WAGES AND SALARY, BE TERMINATED AT ANY TIME WITHOUT ANY PREVIOUS NOTICE

DATE SIGNATURE

DO NOT WRITE BELOW THIS LINE

TO BE COMPLETED DAY EMPLOYMENT BEGINS DATE

HEIGHT WEIGHT AGE DATE OF BIRTH

SINGLE MARRIED WIDOWED CITIZEN U.S.A. SEX

THE ABOVE INFORMATION NEEDED FOR PENSION, HOSPITALIZATION INSURANCE, ETC., AND NOT FOR HIRING PURPOSES

INTERVIEWED BY DATE REMARKS

NEATNESS		CHARACTER	
PERSONALITY		ABILITY	

HIRED FOR DEPT POSITION WILL REPORT SALARY WAGES

APPROVED 1 2 3

EMPLOYMENT MANAGER DEPT HEAD GENERAL MANAGER

Name ______________________ Score ________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

MAKE AN INTERVIEW APPOINTMENT BY TELEPHONE FOR A CONSTRUCTION JOB

INTRODUCTION

Making an appointment by telephone accomplishes two things. First, it shows that you are interested in saving the employer's time. Second, it shows that you are thoughtful enough to ask the best time for you to see the employer.

Part 1

DIRECTIONS

Read the following steps and reminders for making an interview appointment by telephone.

Guidelines

Oral Presentation Skills
- Use good speaking techniques
- Select/use words effectively

Listening Skills
- Apply active listening skills

1. Steps in making an appointment:
   - Plan what you are going to say before you call.
   - State your name and reason for calling.

     EXAMPLE: "Hello, this is Terry McKracken. I am calling about your ad for a bricklayer that appeared in last night's paper. May I make an appointment for an interview?"

   - Ask when would be the best time for you to come for the interview and ask for the name of the interviewer.
   - Record the day, time, and place of the interview, and the name of the interviewer.

Interactive Communication Skills
- Communicate with professional colleagues/ associates

- Ask if you should pick up an application form or if they would like to send it to you before the interview.
- Thank the receptionist for the help.

2. Things to remember:

   - Remember that this call is the first contact you may have with the firm; make that first impression a good one.
   - Keep the receptionist on your side; the receptionist is there to help you.
   - Do not ask over the telephone how much the job pays.
   - Be polite and courteous.
   - Use a note pad and pen for taking notes.

Job Search/ Selection Skills
- Investigate employment prospects of a career field/occupation

Part 2

INSTRUCTIONS

Now that you have read about the correct way to arrange for a job interview, role-play a situation in which you make an interview appointment for a job as a bricklayer by telephone. Use the following checklist to evaluate your performance.

	Yes	No
Was prepared before calling	___	___
Did not have to stammer to find the right words	___	___
Immediately identified self	___	___
Asked the best time for an appointment with employer	___	___
Was courteous and friendly	___	___
Asked about picking up application form or having application form sent prior to interview	___	___
Thanked the receptionist	___	___
Made record of the interview date, hour, and place, and of interviewer's name	___	___

Part 3

DIRECTIONS Some companies allow you to apply for a job on-site. Use the following checklist to evaluate a role-play for an on-site visit.

	Yes	No
Were you well prepared for a verbal interview?	___	___
Did you introduce yourself and make it clear the job you want?	___	___
Were you dressed appropriately for the job?	___	___
Were you courteous and friendly?	___	___
Do you have the required tools to start the job now?	___	___
Were you prepared to go to the company's office, if necessary, to complete employment paperwork?	___	___
If turned down, did you thank the supervisor and ask to try again should an opening become available?	___	___

Name ____________________ Score ________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

PRACTICE INTERVIEW QUESTIONS

INTRODUCTION

An employer may not legally ask questions about an applicant's personal life. In fact, it is illegal for an employer to ask what your maiden name is if you are a female applicant; what your marital status is; who lives with you; what church you attend or who your spiritual leader is; how many children you have, their ages, or who will care for them while you are at work; whether you rent or own your residence; whether you have ever had your wages garnisheed; or whether you have ever been arrested. However, many interviewers, particularly those in small businesses, sometimes ask such questions anyway. Whether or not you choose to answer such questions depends on how much you want the job.

INSTRUCTIONS

Language Skills
- State ideas clearly

The following questions are some that might be asked on an application form or during a job interview. Write an answer for each question. Keep this assignment sheet to review before going to an interview.

1. Why did you leave your previous job?

   NOTE: Try to be positive in stating your reasons for leaving a former job. Do not downgrade your previous employer.

   ____

   ____

Job Search/
Selection Skills
- Analyze personal occupational aptitudes/preferences

2. What did you like best about your job?

____

____

3. Are you in good health? ______________________________

4. Do you intend to make this work your career? ______________

5. What are some of your special abilities?

____

____

6. What equipment do you operate?

____

____

7. How would you rate your training for this job? Very good? Fair? Why?

____

8. What personal characteristics do you think are needed to succeed in your vocation?

____

____

9. At what salary do you expect to start? ______________

10. How could you contribute to our organization?

____

____

____

11. Why should we hire you?

____

____

____

12. Tell us about your family and any plans for marriage or further education.

NOTE: Remember, legally you do not have to answer this question. However, it is a good idea to have an answer.

____

____

13. Have you applied for any other job?

____

14. Do you have any military obligations to fulfill?

____

15. Would you be able to work Saturdays and Sundays?

____

17. Would you be willing to relocate?

____

18. What size city do your prefer? Why?

____

____

19. Define *cooperation.*

____

____

20. How do you feel about working overtime?

____

____

21. Have you had any work related accidents?

Describe __________________________________

____

____

____

REMEMBER: You never get a second chance to make a good first impression. Getting a job is a job!

Name ______________________________ Score ________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

WRITE A FOLLOW-UP LETTER OR MAKE A FOLLOW-UP TELEPHONE CALL AFTER INTERVIEWING FOR A CARPENTRY JOB

INTRODUCTION

It is sometimes helpful to return to a business and check again on possible job openings. This is often done about a week after the first interview. This short, casual visit accomplishes two things. It helps the interviewer remember you, and it shows that you have a sincere interest in working for that company.

It is not always possible to have this type of informal atmosphere when applying for a job. However, it is always proper to send a follow-up letter or to make a follow-up telephone call.

Part 1

INSTRUCTIONS

Write a follow-up letter thanking the employer for the interview. Use any form you wish or follow the format of the sample follow-up letter included with this assignment sheet. Use the information below as a guide.

Guidelines

1. Make sure that your letter meets the following standards:
    - Typed or written perfectly
    - Clean, neat, and attractively arranged on the page
    - Free of spelling, punctuation, and grammatical errors
    - Sent within a day or two after the interview

Language Skills
- Use standard grammar, spelling, and capitalization

- State ideas clearly

Composition Skills
- Use complete sentences
- Use introductory/closing paragraphs

Job Acquisition/Development Skills
- Apply business etiquette

2. Include the following points in your follow-up letter:

   - Expression of appreciation for interviewer's time and interest
   - Summary of your qualifications and interest in position
   - Your name, address, and telephone number (to make it easier for your employer to contact you)

3. Make this last bid for the job a prime example of your excellent work habits; write a clean, neat, and well-worded letter.

SAMPLE FOLLOW-UP LETTER

774 East Adams Street
Anytown, Yourstate 77704
September 3, 199-

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Progressville, Yourstate 77802

Dear Mr. Jones:

Thank you for interviewing me for the job of electrician with your company. I feel that working for Jones Construction Company would be enjoyable and that I could do the electrical work that the job requires. I hope that I will have the opportunity to prove my worth.

The application form you gave me is enclosed.

I will be available for work October 15. You may call me at my home after 3:30 P.M. The number is (999) 999-9999.

Sincerely yours,

Terry McKracken

Enclosure

Part 2

INSTRUCTIONS

Address a legal-sized envelope and insert folded follow-up letter.

Type the address on the envelope exactly the same as the inside address of the letter.

Terry McKracken
774 East Adams Street
Anytown, Yourstate 77704

Stamp

Mr. John Jones
Personnel Director
Jones Construction Company
Box 19
Progressville, Yourstate 77802

Part 3

INSTRUCTIONS

Role-play a follow-up telephone call. Make sure to include the following information: your name, the date of your interview, and the position for which you were interviewed.

1. Ask whether a decision has been made.

EXAMPLES: **Incorrect:** "Hello, Mr. Jones. This is Terry McKracken. You told me you would let me know about the job, but I haven't heard anything from you. Why haven't you called me?"

Incorrect: "This is Terry McKracken. Did I get the job?"

Correct: "Hello, Mr. Jones. This is Terry McKracken. I interviewed with you on

September 15 for a position of electrician. I wanted to check with you to see if any additional information is needed to make your decision."

2. If someone else has already been hired, thank the interviewer for considering you and express continued interest in working for the company.

EXAMPLES: **Incorrect:** "Oh well, that's my luck. Thanks anyway."

Incorrect: "I didn't want to work for your company anyway."

Correct: "I am sorry I was not hired. Thank you for considering my application. I am still interested in working for the company and would appreciate your keeping my application on file."

Name ______________________________ Score __________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

COMPARE JOB OPPORTUNITIES

INTRODUCTION

When you are offered a job, there are many factors to weigh before taking the position. Some of these factors include take-home pay, benefits that accompany the job, actual cost of being at work each day, how satisfying the job would be, and how the job would meet your needs and aspirations.

Part 1

INSTRUCTIONS

Cognitive Activity Skills

- Collect/record information
- Identify critical elements/issues
- Analyze/synthesize information
- Draw conclusions

There are certain questions that you should ask yourself when weighing job opportunities. Part 1 of this activity sheet outlines some of those questions. Using information from jobs for which you have applied or those in which you are interested, complete the following activities.

1. What benefits besides pay do I get from the job?

   Some benefits associated with working are not always visible. Often some of these overlooked benefits are paid for in part by your employer. Obtain information about the benefits in the jobs you are considering. Be sure to note any benefits that must be paid for in part or completely by the employee. At the time of the interview, or when considering a position, ask about the following benefits:

Job Search/ Selection Skills

- Investigate benefits of a career field/occupation
- Compare/evaluate career options
- Analyze duties/ requirements/ benefits of specific job

a. Employer's contributions for your protection that may include:

- Health insurance
- Unemployment compensation
- Clothing and safety garments
- Medical facilities and health tests
- Pensions
- Travel insurance (covering mishaps when traveling on business)
- Educational programs or reimbursement for courses related to job

b. Sick leave with pay

c. Paid vacations and holidays

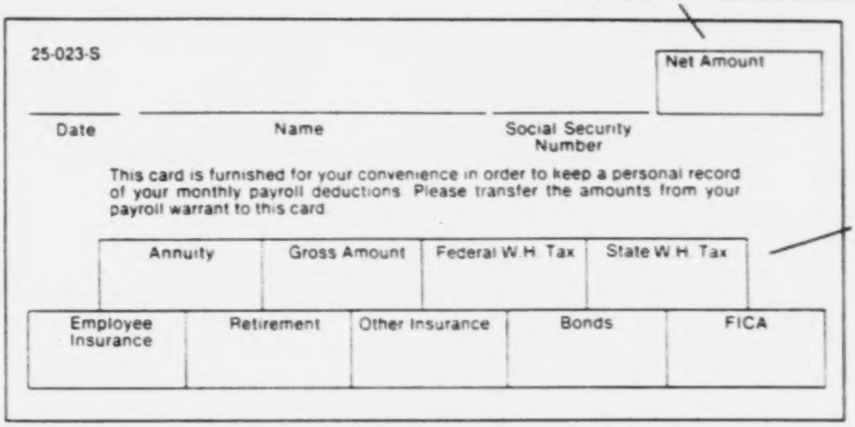
2. What is my take-home pay?

Salaries and wages are often quoted by employers as *gross earnings*. Gross earnings are used because tax deductions vary depending upon the number of dependents, the amount of earnings, and other information.

Optional benefits and deductions offered by an employer also differ. It is generally advisable to ask what programs are available because such programs can affect the actual money you receive on payday.

Information about your earnings and withholdings is often recorded on a form such as the one shown on the following page. Use the information about salary and payroll deductions provided by employers or by your instructor, along with tax information provided by your instructor, to determine take-home pay for the jobs you are considering.

NET PAY is the actual money you receive on payday after all required and optional deductions have been taken out.



25-023-S

Net Amount

Date

Name

Social Security Number

This card is furnished for your convenience in order to keep a personal record of your monthly payroll deductions. Please transfer the amounts from your payroll warrant to this card.

Annuity	Gross Amount	Federal W.H. Tax	State W.H. Tax

Employee Insurance	Retirement	Other Insurance	Bonds	FICA

Basic required deductions, federal tax, and social security

3. What will it cost to work at this job?

Frequently, the costs associated with being employed are overlooked. It may be of value to calculate estimated weekly expenses before making a decision about a job.

Estimate weekly expenses for

Transportation, gasoline, parking, and bus fares $ __________

Child care $ __________

Organizational dues (if applicable) $ __________

Lunches (cost of food eaten away from home, including soft drinks and coffee) $ __________

Clothing or special uniforms (including cleaning) $ __________

Tools $ __________

Other $ __________

TOTAL $ __________

4. What is important to me in a job?

Take-home pay and benefits may be only part of what you want from a job. Think through other things you consider important in a job.

a. What have been some of your most rewarding job experiences? Why?

____

____

____

b. Rate the following in order of what is important to you, with "1" being the most important.

_____ Job security (little chance you will be released from the job)

_____ Opportunity for advancement

_____ Recognition for your work

_____ Good wages

_____ Opportunity to learn and use your ideas

_____ Flexible working conditions

_____ Long vacations

_____ Pleasant working conditions

_____ Interesting work

_____ Friendly co-workers

Part 2

INSTRUCTIONS

To reach a decision about whether you want the job or not, summarize the information you have gathered.

1. Would the job be satisfying to me? Why or why not?

____

____

____

2. What are the benefits that accompany the job?

____

3. How much will it actually cost to be at work each day?

____

4. How would the job meet my needs and aspirations?

____

____

____

5. I estimate my take-home pay to be $ ____________________

6. I estimate my expenses related to working to be $ ____________

7. I estimate my job benefits to be worth $ ____________________

8. I would most enjoy the following about this job.

____

____

____

ASSIGNMENT SHEET 7 — INDUSTRY ORIENTATION — A 1

Name ______________________________ Score ________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

COMPLETE A W-4 FORM

INTRODUCTION

The law requires that any working person must complete a W-4 form so that employers can withhold federal income tax from employees' pay. Your W-4 form remains in effect until you change it, or if you entered "Exempt" on line b, until February 15 of next year. By correctly completing this form, you can match the amount of tax withheld from wages to your tax liability.

DIRECTIONS

Complete the W-4 tax form on the next page, using the guidelines below and information about yourself.

GUIDELINES

Functional Reading Skills
- Interpret forms and records
- Follow written instructions

Functional Writing Skills
- Complete forms and records

Job Acquisition/ Development Skills
- Complete job-related applications

1. Be prepared.
2. Follow directions.
3. Write or print clearly, neatly, and legibly.
4. Answer all questions honestly.
5. Include complete information.
6. Recheck form when finished.
7. Avoid crossing out and erasing.
8. Do not write in boxes #8 and #9.

When you are sure the form is correct and complete, detach at the perforated line and give the lower part to your employer (instructor); keep the top part for your records and information.

1993 Form W-4

Department of the Treasury
Internal Revenue Service

Purpose. Complete Form W-4 so that your employer can withhold the correct amount of Federal income tax from your pay

Exemption From Withholding. Read line 7 of the certificate below to see if you can claim exempt status. *If exempt, complete line 7, but do not complete lines 5 and 6.* No Federal income tax will be withheld from your pay. Your exemption is good for one year only. It expires February 15, 1994

Basic Instructions. Employees who are not exempt should complete the Personal Allowances Worksheet. Additional worksheets are provided on page 2 for employees to adjust their withholding allowances based on itemized deductions, adjustments to income, or two-earner/two-job situations. Complete all worksheets that apply to your situation. The worksheets will help you figure the number of withholding allowances you are entitled to claim. However, you may claim fewer allowances than this

Head of Household. Generally, you may claim head of household filing status on your tax return only if you are unmarried and pay more than 50% of the costs of keeping up a home for yourself and your dependent(s) or other qualifying individuals.

Nonwage Income. If you have a large amount of nonwage income, such as interest or dividends, you should consider making estimated tax payments using Form 1040 ES. Otherwise, you may find that you owe additional tax at the end of the year

Two-Earner/Two-Jobs. If you have a working spouse or more than one job, figure the total number of allowances you are entitled to claim on all jobs using worksheets from only one Form W-4. This total should be divided among all jobs. Your withholding will usually be most accurate when all allowances are claimed on the W-4 filed for the highest paying job and zero allowances are claimed for the others

Advance Earned Income Credit. If you are eligible for this credit, you can receive it added to your paycheck throughout the year. For details, get Form W-5 from your employer

Check Your Withholding. After your W-4 takes effect, you can use **Pub. 919,** Is My Withholding Correct for 1993?, to see how the dollar amount you are having withheld compares to your estimated total annual tax. Call 1-800-829-3676 to order this publication. Check your local telephone directory for the IRS assistance number if you need further help

Personal Allowances Worksheet

For 1993, the value of your personal exemption(s) is reduced if your income is over $108,450 ($162,700 if married filing jointly, $135,600 if head of household, or $81,350 if married filing separately). Get Pub. 919 for details.

A Enter "1" for **yourself** if no one else can claim you as a dependent . . . . **A** ______

B Enter "1" if:
- You are single and have only one job; or
- You are married, have only one job, and your spouse does not work; or
- Your wages from a second job or your spouse's wages (or the total of both) are $1,000 or less.

B ______

C Enter "1" for your **spouse.** But, you may choose to enter -0- if you are married and have either a working spouse or more than one job (this may help you avoid having too little tax withheld) . . . . **C** ______

D Enter number of **dependents** (other than your spouse or yourself) whom you will claim on your tax return . . . . . **D** ______

E Enter "1" if you will file as **head of household** on your tax return (see conditions under **Head of Household,** above) **E** ______

F Enter "1" if you have at least $1,500 of **child or dependent care expenses** for which you plan to claim a credit **F** ______

G Add lines A through F and enter total here. **Note:** *This amount may be different from the number of exemptions you claim on your return* ▶ **G** ______

For accuracy, do all worksheets that apply.
- If you plan to **itemize or claim adjustments to income** and want to reduce your withholding, see the Deductions and Adjustments Worksheet on page 2.
- If you are **single** and have **more than one job** and your combined earnings from all jobs exceed $30,000 OR if you are **married** and have a **working spouse or more than one job,** and the combined earnings from all jobs exceed $50,000, see the Two-Earner/Two-Job Worksheet on page 2 if you want to avoid having too little tax withheld
- If **neither** of the above situations applies, **stop here** and enter the number from line G on line 5 of Form W-4 below.

Cut here and give the certificate to your employer. Keep the top portion for your records.

Form **W-4**
Department of the Treasury
Internal Revenue Service

Employee's Withholding Allowance Certificate

▶ **For Privacy Act and Paperwork Reduction Act Notice, see reverse.**

OMB No. 1545-0010
1993

1 Type or print your first name and middle initial | Last name | 2 Your social security number

Home address (number and street or rural route)

3 ☐ Single ☐ Married ☐ Married, but withhold at higher Single rate
Note: *If married, but legally separated, or spouse is a nonresident alien, check the Single box.*

City or town, state, and ZIP code

4 If your last name differs from that on your social security card, check here and call 1-800-772-1213 for more information . . . . ▶ ☐

5 Total number of allowances you are claiming (from line G above or from the worksheets on page 2 if they apply) **5** ______

6 Additional amount, if any, you want withheld from each paycheck . . . . **6** $ ______

7 I claim exemption from withholding for 1993 and I certify that I meet **ALL** of the following conditions for exemption:
- Last year I had a right to a refund of **ALL** Federal income tax withheld because I had **NO** tax liability; **AND**
- This year I expect a refund of **ALL** Federal income tax withheld because I expect to have **NO** tax liability; **AND**
- This year if my income exceeds $600 and includes nonwage income, another person cannot claim me as a dependent.

If you meet all of the above conditions, enter "EXEMPT" here . . . . ▶ **7** ______

Under penalties of perjury, I certify that I am entitled to the number of withholding allowances claimed on this certificate or entitled to claim exempt status.

Employee's signature ▶ **Date ▶** , 19

8 Employer's name and address (Employer: Complete 8 and 10 only if sending to the IRS) | 9 Office code (optional) | 10 Employer identification number

Cat. No. 10220Q

Form W-4 (1993) Page **2**

Deductions and Adjustments Worksheet

Note: *Use this worksheet only if you plan to itemize deductions or claim adjustments to income on your 1993 tax return.*

1 Enter an estimate of your 1993 itemized deductions. These include: qualifying home mortgage interest, charitable contributions, state and local taxes (but not sales taxes), medical expenses in excess of 7.5% of your income, and miscellaneous deductions. (For 1993, you may have to reduce your itemized deductions if your income is over $108,450 ($54,225 if married filing separately). Get Pub. 919 for details.) 1 $ ______

2 Enter { $6,200 if married filing jointly or qualifying widow(er) / $5,450 if head of household / $3,700 if single / $3,100 if married filing separately } 2 $ ______

3 **Subtract** line 2 from line 1. If line 2 is greater than line 1, enter -0- 3 $ ______

4 Enter an estimate of your 1993 adjustments to income. These include alimony paid and deductible IRA contributions 4 $ ______

5 **Add** lines 3 and 4 and enter the total 5 $ ______

6 Enter an estimate of your 1993 nonwage income (such as dividends or interest income) 6 $ ______

7 **Subtract** line 6 from line 5. Enter the result, but not less than -0- 7 $ ______

8 **Divide** the amount on line 7 by $2,500 and enter the result here. Drop any fraction 8 ______

9 Enter the number from Personal Allowances Worksheet, line G, on page 1 9 ______

10 **Add** lines 8 and 9 and enter the total here. If you plan to use the Two-Earner/Two-Job Worksheet, also enter the total on line 1, below. Otherwise, **stop here** and enter this total on Form W-4, line 5, on page 1 10

Two-Earner/Two-Job Worksheet

Note: *Use this worksheet only if the instructions for line G on page 1 direct you here.*

1 Enter the number from line G on page 1 (or from line 10 above if you used the Deductions and Adjustments Worksheet) 1 ______

2 Find the number in **Table 1** below that applies to the **LOWEST** paying job and enter it here 2 ______

3 If line 1 is **GREATER THAN OR EQUAL TO** line 2, subtract line 2 from line 1. Enter the result here (if zero, enter -0-) and on Form W-4, line 5, on page 1. **DO NOT** use the rest of this worksheet 3 ______

Note: *If line 1 is* ***LESS THAN*** *line 2, enter -0- on Form W-4, line 5, on page 1. Complete lines 4–9 to calculate the additional withholding amount necessary to avoid a year-end tax bill.*

4 Enter the number from line 2 of this worksheet 4 ______

5 Enter the number from line 1 of this worksheet 5 ______

6 **Subtract** line 5 from line 4 6 ______

7 Find the amount in **Table 2** below that applies to the **HIGHEST** paying job and enter it here 7 $ ______

8 **Multiply** line 7 by line 6 and enter the result here. This is the additional annual withholding amount needed 8 $ ______

9 Divide line 8 by the number of pay periods remaining in 1993. (For example, divide by 26 if you are paid every other week and you complete this form in December 1992.) Enter the result here and on Form W-4, line 6, page 1. This is the additional amount to be withheld from each paycheck 9 $

Table 1: Two-Earner/Two-Job Worksheet

Married Filing Jointly		All Others	
If wages from **LOWEST** paying job are—	Enter on line 2 above	If wages from **LOWEST** paying job are—	Enter on line 2 above
0 - $3,000	0	0 - $6,000	0
3,001 - 8,000	1	6,001 - 11,000	1
8,001 - 13,000	2	11,001 - 15,000	2
13,001 - 18,000	3	15,001 - 19,000	3
18,001 - 22,000	4	19,001 - 24,000	4
22,001 - 27,000	5	24,001 - 50,000	5
27,001 - 31,000	6	50,001 and over	6
31,001 - 35,000	7		
35,001 - 40,000	8		
40,001 - 60,000	9		
60,001 - 85,000	10		
85,001 and over	11		

Table 2: Two-Earner/Two-Job Worksheet

Married Filing Jointly		All Others	
If wages from **HIGHEST** paying job are—	Enter on line 7 above	If wages from **HIGHEST** paying job are—	Enter on line 7 above
0 - $ 50,000	$350	0 - $30,000	$350
50,001 - 100,000	660	30,001 - 60,000	660
100,001 and over	730	60,001 and over	730

Privacy Act and Paperwork Reduction Act Notice.—We ask for the information on this form to carry out the Internal Revenue laws of the United States. The Internal Revenue Code requires this information under sections 3402(f)(2)(A) and 6109 and their regulations. Failure to provide a completed form will result in your being treated as a single person who claims no withholding allowances. Routine uses of this information include giving it to the Department of Justice for civil and criminal litigation and to cities, states, and the District of Columbia for use in administering their tax laws.

The time needed to complete this form will vary depending on individual circumstances. The estimated average time is: **Recordkeeping** 46 min., **Learning about the law or the form** 10 min., **Preparing the form** 69 min. If you have comments concerning the accuracy of these time estimates or suggestions for making this form more simple, we would be happy to hear from you. You can write to both the **Internal Revenue Service,** Washington, DC 20224, Attention: IRS Reports Clearance Officer, T:FP; and the **Office of Management and Budget,** Paperwork Reduction Project (1545-0010), Washington, DC 20503. **DO NOT** send the tax form to either of these offices. Instead, give it to your employer.

☆ U.S. GOVERNMENT PRINTING OFFICE: 1992 - 315-080

vo-tech

BEST COPY AVAILABLE

ASSIGNMENT SHEET 8

Name ______________________________ Score __________

OBJECTIVE 10

Research personal data necessary to complete employment forms and prepare for job search activities.

COMPLETE AN EMPLOYMENT ELIGIBILITY VERIFICATION (FORM I-9)

INTRODUCTION

The immigration Reform and Control Act of 1986 requires all new employees and their employers to complete Form I-9. The new employees complete the top half of the form on their first day of actual employment, and the employers normally have three business days to review their new employees' documents and to complete the bottom half of the form.

INSTRUCTIONS

Complete the top section $\boxed{1}$ of the Form I-9 on the next page, using the guidelines below and information about yourself.

Functional Reading Skills
- Interpret forms and records
- Follow written instructions

Functional Writing Skills
- Complete forms and records

Job Acquisition/ Development Skills
- Complete job-related applications

GUIDELINES

- Be prepared.
- Follow directions.
- Write or print clearly, neatly, and legibly.
- Answer all questions honestly.
- Include complete information.
- Recheck form when finished.
- Avoid crossing out and erasing.

When you are sure the form is correct and complete, hand it in to your instructor.

Top Section

EMPLOYMENT ELIGIBILITY VERIFICATION (Form I-9)

1 EMPLOYEE INFORMATION AND VERIFICATION: (To be completed and signed by employee.)

Name: (Print or Type) Last	First	Middle	Birth Name
Address: Street Name and Number	City	State	ZIP Code
Date of Birth (Month/Day/Year)		Social Security Number	

I attest, under penalty of perjury, that I am (check a box):

☐ 1. A citizen or national of the United States

☐ 2. An alien lawfully admitted for permanent residence (Alien Number A ____________)

☐ 3. An alien authorized by the Immigration and Naturalization Service to work in the United States (Alien Number A ____________, or Admission Number ____________, expiration of employment authorization, if any ____________)

I attest, under penalty of perjury, the documents that I have presented as evidence of identity and employment eligibility are genuine and relate to me. I am aware that federal law provides for imprisonment and/or fine for any false statements or use of false documents in connection with this certificate.

Signature	Date (Month/Day/Year)

PREPARER/TRANSLATOR CERTIFICATION (To be completed if prepared by person other than the employee). I attest, under penalty of perjury, that the above was prepared by me at the request of the named individual and is based on all information of which I have any knowledge.

Signature		Name (Print or Type)	
Address (Street Name and Number)	City	State	Zip Code

2 EMPLOYER REVIEW AND VERIFICATION: (To be completed and signed by employer.)

Instructions

Examine one document from List A and check the appropriate box, ***OR*** examine one document from List B ***and*** one from List C and check the appropriate boxes.

Provide the ***Document Identification Number*** and ***Expiration Date*** for the document checked.

List A
Documents that Establish
Identity and Employment Eligibility

☐ 1 United States Passport

☐ 2 Certificate of United States Citizenship

☐ 3 Certificate of Naturalization

☐ 4 Unexpired foreign passport with attached Employment Authorization

☐ 5 Alien Registration Card with photograph

Document Identification

# ______________________

Expiration Date (if any)

____

List B
Documents that Establish
Identity

and

☐ 1 A State-issued driver's license or a State-issued I.D. card with a photograph, or information, including name, sex, date of birth, height, weight, and color of eyes.
(Specify State) ______________________)

☐ 2 U.S. Military Card

☐ 3 Other (Specify document and issuing authority)

____

Document Identification

# ______________________

Expiration Date (if any)

____

List C
Documents that Establish
Employment Eligibility

☐ 1 Original Social Security Number Card (other than a card stating it is not valid for employment)

☐ 2 A birth certificate issued by State, county, or municipal authority bearing a seal or other certification

☐ 3 Unexpired INS Employment Authorization
Specify form
# ______________________

Document Identification

# ______________________

Expiration Date (if any)

____

CERTIFICATION: I attest, under penalty of perjury, that I have examined the documents presented by the above individual, that they appear to be genuine and to relate to the individual named, and that the individual, to the best of my knowledge, is eligible to work in the United States.

Signature	Name (Print or Type)	Title
Employer Name	Address	Date

Form I-9 (05/07/87)
OMB No. 1115-0136

U.S. Department of Justice
Immigration and Naturalization Service

Name ______________________ Score ________

OBJECTIVE 11

Complete a personal information sheet.

INTRODUCTION

As you seek a job, you will be asked to complete various forms. You must always try to complete these forms neatly and accurately. Once you are hired, there will be other forms to fill out, usually including a form for personal information that may be necessary should the company need to contact your next of kin. Because of the jobs you will be performing in this program, such information will also be of use to your instructor.

INSTRUCTIONS

Functional Writing Skills
- **Complete forms and records**

Complete the following personal information sheet and hand it in to your instructor.

Name ______________________ Class ________

Home Address ______________________

Home Phone ______________________

Parents' (Guardians') Names ______________________

Person to Contact in Case of Emergency ______________________

____

Phone Number ______________________

Parents' Business Phones ______________________

Place Where Parents Can Be Reached in Case of an Emergency

____

____

Family Doctor ______________________ Phone ________

Name of Insurance Company ______________________

____

ASSIGNMENT SHEET 10

INDUSTRY ORIENTATION A 1

Name ______________________ Score __________

OBJECTIVE 12 **Write a resumé.**

INTRODUCTION

A good resumé should immediately give prospective employers a brief summary of your accomplishments, educational background, work experience, skills, and job objective.

INSTRUCTIONS

Write a resumé, using accurate facts about yourself. Use the following information and the sample included in this assignment sheet as guides. It is not necessary to use the exact wording and outline form used on the sample, but it is necessary that your resumé be neat and balanced and contain all the information that might help you get a job.

Keep your resumé updated, and use it when you apply for jobs.

GUIDELINES

- Inspect several resumé formats and choose one that best fits your needs, or use the example included in this assignment sheet as a guide.
- Type your resumé on 8½-by-11 inch white paper. Try not to exceed one page, but attempt to fill the page.
- Spell correctly. Many employers will not consider persons whose resumés include misspelled words.
- Put your name prominently at the center top or in the upper left-hand corner. Beneath your name, give full street address, city, state, ZIP code, telephone number with area code, and a number where messages can be accepted.

  NOTE: You may want to leave space to fill in your address on a printed resumé if you expect to change addresses.

Language Skills
- Use standard grammar, spelling, and capitalization
- State ideas clearly

Composition Skills
- Use complete sentences
- Proofread and edit

Functional Writing Skills
- Write resumes

Job Acquisition/Development Skills

- Write personal resumé

- Do not include birthplace, age, health, height, weight, sex, marital status, photograph, salary, or reasons for leaving previous job. Avoid giving religious and political affiliations.

  NOTE: In general, the more information you are wiling to share the better; however, the whole point of the resumé is to interest employers in meeting you. The above information may or may not be asked during the interview. By not including this information, there is little or no chance for discrimination because of race, color, religion, sex, or national origin.

- Describe your job objective or career goal briefly. Do not restrict yourself to a specific job.

- Describe your educational background, giving dates of enrollment, diplomas or degrees received, and names of schools attended. Include grade average (if favorable) and major course of study. If you include school grades, be sure that they are related to the jobs you have in mind.

  NOTE: Applicants with less than one year of work experience should list education before work experience; with more than one year, put experience first. In resumé writing, accentuate the positive, eliminate the negative. If pertinent, mention additional courses, scholarships, or summer school.

- List your past employment, starting with your most recent job. Carefully examine all of your jobs — including extracurricular activities. Concentrate on the skills; do not categorize "summer jobs."

  NOTE: The list should include the name of the company, your job title, and your major duties. The starting and termination dates for each job should also be listed.

- List skills useful to the job. Remember, you have to prove your value to the business, especially if you have little experience.

  NOTE: Use active verbs to indicate the specific tasks you performed, e.g. *built, assisted, operated.*

- Include the following information if it is relevant and if there is enough space; hobbies and interests, extracurricular activities, clubs, and awards you have received.

- Ask at least three persons to serve as your references; ask yourself the kinds of recommendations they will give you. These references should be recorded on a separate sheet and *not* as part of your resumé. If interested, the prospective employer will request reference information.

  EXAMPLES: Business references (previous employers and co-workers), school references (teachers), character references (minister, rabbi, neighbor who knows you well)

  NOTE: Avoid listing relatives unless you have actually worked for them on a salaried basis. Include addresses, titles, and phone numbers.

- Write "CONFIDENTIAL" at the top of the resumé if you do not want your current employer to know that you are looking for employment.

- Have a local printer retype your resumé and reproduce several copies. Request white or ivory bond paper.

  NOTE: The physical appearance of your resumé is *very* important. Avoid using ditto or carbon copies. Be sure to proofread the printer's work. Always take extra copies to the interview. Leave one copy of your resumé with the interviewer and use one as a reference when filling out the application form. You should also mail one resumé with your letter of application.

SAMPLE RESUMÉ

Terry L. McKracken
774 East Adams Street
Anytown, Your state 77704
Phone: (999)999-9999

September 3, 199-

Job Objective: Career in carpentry leading to position of construction manager

EDUCATION

1987-1991 Anytown High School, Anytown, Yourstate 77704
Activities: President of senior class
Career-related courses: Algebra, two semesters; geometry, two semesters; industrial arts woodworking, two semesters

1990-1991 Progress Vo-Tech, Progressville, Yourstate 77802
Activities: President of VICA
Honors: Carpentry contest, 1st place, state; 3rd place, national
Courses: Vocational carpentry, two years (1,080 hours); basic drafting, two semesters
Certificate: Carpentry, four semesters
Grade average: 3.5 on a 4.0 scale

1992 AGC Craftsworker Certification — Commercial Frame Carpenter

WORK EXPERIENCE

1993 - Jones Construction Company, Progressville, Yourstate 77802

Work as carpenter's helper; responsible for assisting with building layout, framing of exterior and interior walls, erecting trusses, installing sheathing, decking roofs, laying flooring, hanging drywall, installing exterior finish

1990-1991 Vocational Carpentry Class, Progressville, Yourstate 77802

As a student, built or assisted with all phases of construction; learned and observed basic safety and first-aid rules

1990-1991 Your Fellowship Organization, Anytown, Yourstate 77704

Work as treasurer required planning and organization, written reports, math and accounting skills, and collection responsibilities

ASSIGNMENT ANSWERS — INDUSTRY ORIENTATION — A 1

ASSIGNMENT SHEETS 1-8

Answers are specific to individuals: ask your instructor to evaluate.

ASSIGNMENT SHEET 9

- Information sheet completed
- Sheet neatly done
- Information accurate

ASSIGNMENT SHEET 10

- Good choice of format
- Properly typed on 8½-by-11 inch white paper
- Properly filled page
- Spelling correct
- Name and address properly placed at top center or in the upper left-hand corner
- Avoided religious and political affiliations
- Briefly described job objective or career goal
- Properly described educational background
- Properly listed past employment and skills
- Properly listed specific tasks performed
- Properly listed references

WRITTEN TEST

INDUSTRY ORIENTATION **A 1**

Name ______________________ Score ________

OBJECTIVE 1

Given a list of terms associated with free enterprise, match them to their correct definitions. Write the letter that corresponds to the most correct answer in the blank.

_____ 1. Which of the following terms is used to describe wealth that is used or capable of being used to support production of a product?

a. Labor
b. Capital
c. Supply
d. Profit

_____ 2. The amount of a resource that is available for exchange at a specific time and for a given price is known as

a. capital
b. labor
c. services
d. supply

_____ 3. Which of the following terms describes an economic principle in which the price of goods and services is based upon their availability and the consumer's desire for them?

a. Regulation principle
b. Economic value
c. Profit ratio
d. Supply and demand

_____ 4. What is the term used to describe the money a producer has left after selling goods and services and paying all expenses required to produce?

a. Demand
b. Capital
c. Profit
d. Enterprise

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______ 5. Currency or checks are often used in exchange for goods and services. What is the term used to describe these materials?

a. Medium of exchange
b. Supply side
c. Goods
d. Profit

______ 6. The material required to produce and distribute goods and services is best described as a/an

a. service
b. profit margin
c. product
d. resource

______ 7. The raw materials required for production, such as water and fuel, are best described as

a. products
b. medium of exchanges
c. natural resources
d. capitals

______ 8. A person who organizes and manages a business is known as a/an

a. entrepreneur
b. salesman
c. employee
d. enterpriser

______ 9. The total value of our nation's goods and services produced in a given year is known as our

a. profit
b. output
c. PDE
d. GNP

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OBJECTIVE 2

Provided with a list of alternatives, select factors that the construction industry contribute to free enterprise.

_____ 1. In 1992, the construction industry provided _____ % of the gross national product.

a. 1
b. 4
c. 8
d. 12

_____ 2. Thousands of other businesses benefit from the construction industry, they include

a. steel mills
b. lumber mills
c. trucking industry
d. all the above

_____ 3. The construction industry employed nearly _____ men and women in 1992.

a. 5 million
b. 8 million
c. 12 million
d. 16 million

OBJECTIVE 3

Given a list of choices, pick the roles government plays in our free enterprise system.

_____ 1. Which of the following roles does our government play to aid in control of our free enterprise system?

a. Sets all prices on goods/services
b. Imposes all contract terms
c. Controls interest rates
d. Restricts the level of profit to 6%

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_____ 2. The overall goal of government in the free enterprise system is to

a. ensure a degree of fairness in the marketplace
b. restrict businesses from expanding
c. control the profit margins of all companies
d. impose restrictions on all markets

OBJECTIVE 4 **Given a list of alternatives, select levels of training recommended for major construction-related careers.**

_____ 1. What level of training is recommended for most construction management careers?

a. Preparatory
b. Apprenticeship
c. Upgrade
d. Post-secondary

_____ 2. What level of training has been recommended for *all* major construction-related careers?

a. Post-secondary
b. Apprenticeship
c. Preparatory
d. Graduate school

_____ 3. What program is designed to prepare students for emerging technologically advanced careers?

a. Vision 2001
b. Career Step
c. Sci-Fair
d. Tech-Prep

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OBJECTIVE 5 **Choose job opportunities open to skilled construction workers.**

______ 1. What job opportunities are open to skilled construction workers?

a. Project manager
b. Television repair
c. Aircraft assembly
d. Health care provider

______ 2. Job opportunities for skilled construction workers would most likely be found in a (an) ________________ business.

a. furniture sales
b. electronic repair
c. mobile home construction
d. plywood mill

OBJECTIVE 6 **Select from a list, personal attributes or attitudes that an employer looks for in an employee.**

______ 1. Which of the following personal attributes or attitudes do employers look for when selecting an employee?

a. Hair style
b. Enthusiasm and interest
c. Religious preference
d. Physical size

OBJECTIVE 7 **Given options, choose the prime goal of continuous improvement programs within the construction industry.**

______ 1. What is the prime goal of quality programs within the construction industry?

a. Improved safety
b. Better contracts
c. Stronger bridges and roadways
d. Constant improvement in every phase of the industry

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OBJECTIVE 8

Given choices, recommend the correct procedures to apply for a construction-related job.

_____ 1. Which of the following procedures is recommended in applying for a construction-related job?

a. Try to telephone the construction site.
b. Go directly to employer office.
c. Go to employer's home and ask for an interview.
d. Call employer's office or visit the job site to ask about hiring procedures.

_____ 2. When applying for a construction-related job

a. wear proper clothes
b. be prepared to fill out documents
c. be prepared for a drug test
d. all the above are recommended

_____ 3. Choose one of the following procedures that should be followed in applying for a job.

a. If hired, be prepared to go to work immediately.
b. Mail your resumé after you apply.
c. Leave your work clothes and tools at home.
d. Do all the above.

OBJECTIVE 9

Select the correct document an applicant may need when applying for a job and state its purpose.

_____ 1. When applying for a job, which of these documents may be needed?

a. Immunization card
b. Social security card
c. Military discharge
d. Marriage license

_____ 2. The purpose of a resumé is to:

a. Summarize your qualifications and experience
b. Verify your identity
c. Allow for salary/tax reporting
d. Prove your citizenship

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_____ 3. When applying for a job, which document is ***not*** needed?

a. Resumé
b. Social security card
c. Voter egistration card
d. Job application

May be photocopied for student use.

INDUSTRY ORIENTATION

OBJECTIVE 1

1. b
2. d
3. d
4. c
5. a
6. d
7. c
8. a
9. d

OBJECTIVE 2

1. d
2. d
3. a

OBJECTIVE 3

1. c
2. a

OBJECTIVE 4

1. d
2. c
3. d

OBJECTIVE 5

1. a
2. c

OBJECTIVE 6

1. b

OBJECTIVE 7

1. d

OBJECTIVE 8

1. d
2. d
3. a

OBJECTIVE 9

1. b
2. a
3. c

NOTE: Objectives 10-12 are evaluated on assignment sheets in this unit. If you have not completed these components, see your instructor.

OBJECTIVE SHEET

STARTING A CONSTRUCTION BUSINESS

A 2

INTRODUCTION

For those considering business ownership, this unit provides some insight into the required skills, business terms, and preparatory steps needed for entrepreneurship. Some may not wish to accept the challenges of business ownership. There is great dignity and satisfaction in a lifelong career as a laborer, craftsperson, construction specialist, or construction manager.

UNIT OBJECTIVES

After completing this unit, the student will be able to evaluate their skills and prepare for business ownership. The student will demonstrate these competencies by completing the assignment sheet and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to show the ability to:

1. Given a list of terms associated with starting a business, match them to their correct definitions.
2. Provided with a list of alternatives, select factors that contribute to the success or failure of a business.
3. Given a list of choices, select resources from which you may receive assistance in starting a business.
4. Evaluate your potential to start a business. (Assignment Sheet 1)
5. Examine expenses involved in starting a business. (Assignment Sheet 2)
6. Explore challenges faced by entrepreneurs in operating a business. (Assignment Sheet 3)

PREPARATION

Review unit and plan presentation.

- Study the specific objectives to determine the order in which you will present the objectives.
- Review teaching suggestions given in the Delivery section and plan classroom activities.
- Plan presentation to take advantage of student learning styles and to accommodate students with special needs.
- Order or obtain materials listed in suggested resources.

DELIVERY

Objective 1: Given a list of terms associated with starting a business, match them to their correct definitions.

- Discuss terms and definitions.
- Use the terms to make sure that the students know that businesses often operate with borrowed capital and leased facilities and equipment in addition to owned capital.
- Explain why the word *entrepreneur* is becoming popular, emphasizing that it carries with it the connotation of someone who is dedicated, skilled, and resourceful and industrious enough to make a business a success.

Objective 2: Provided with a list of alternatives, select factors that contribute to the success or failure of a business.

- Use Supplement 1 to discuss market factors.
- Use Transparencies 1 through 3 to discuss organizational charts and how management factors can contribute to the success or failure of a business.
- Ask a representative of the Small Business Administration to discuss business successes and failures in your area.

Objective 3: Given a list of choices, select resources from which you receive may assistance in starting a business.

- Invite representatives from various agencies to discuss services that their agencies offer.
- Relate the services of each agency to the factors discussed in the information sheets.

APPLICATION

Objective 4: Evaluate your potential to start a business. (Assignment Sheet 1)

Objective 5: Examine expenses involved in starting a business. (Assignment Sheet 2)

- Invite an accountant or management consultant to discuss the advantages and disadvantages of each type of capital source.

Objective 6: Explore challenges faced by entrepreneurs in operating a business. (Assignment Sheet 3)

- Use the "Small Business Reporter Series" materials to acquaint the students with management decisions.

EVALUATION

Pretest

- Give written test as pretest.
- Determine individual study requirements from pretest results.
- Counsel students individually on pretest results and study requirements.
- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.
- Complete appropriate sections of competency profiles.

- Reteach and reevaluate if necessary.
- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- The written test may be given in sections if desired.
- Complete appropriate sections of competency profiles.
- Reteach and retest if necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Print Media

- *Small Business Reporter Series.* Bank of America NT & SA. Available in quantity from Bank of America, Department 3120, P.O. Box 37000, San Francisco, California 94137.

  NOTE: This series covers fifteen business operations and fifteen business profiles.

UNIT REFERENCES

- Everard, Kenneth. *Business Principles and Management.* Southwestern Publishing Company, Cincinnati, OH, 1992.
- Lyon, Barbara. Business Management and Ownership. Stillwater, Oklahoma: Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1982.
- U.S. Small Business Administration. *Presentor's Guide Series: Choosing a Form of Organization for Small Business.* Washington, D.C.: U.S. Government Printing Office, 1980.

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- U.S. Small Business Administration. *Presentor's Guide Series: Sources of Assistance and Information for Small Business.* Washington, D.C.: U.S. Government Printing Office, 1980.

- U.S. Small Business Administration. *Steps to Starting a Business in Oklahoma.* Oklahoma City, Oklahoma: Small Business Administration, n.d.

- Willey, Al. *Fundamentals of Carpentry.* Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America: Stillwater, OK, 1993.

INFORMATION SHEET | *STARTING A CONSTRUCTION BUSINESS* | *A 2*

OBJECTIVE 1

Given a list of terms associated with starting a business, match them to their correct definitions.

- **affirmative action laws** — federal laws that require programs to provide equal employment opportunities for women and ethnic minorities
- **capital** — money, buildings, machines, and investments that are used or available to make products or to provide services
- **cash flow** — the movement of cash into and out of a business
- **competition** — the rivalry among sellers for consumers' dollars
- **entrepreneur** — a person who organizes and manages a business, assuming the risk of the business for the purpose of making a profit
- **ethnic diversity** — a group made up of persons of different cultural backgrounds
- **franchise** — a legal agreement between a parent company and a distributor to sell products or services
- **gender equity** — equal treatment of men and women
- **insurance** — used to protect against the possibility of financial loss
- **lease** — contract to use an item without purchasing it
- **liability insurance** — provides protection for the risks involved in operating the business such as customers being injured or injuries caused by an employee of the business
- **profit** — what a company has left after subtracting all the costs involved with providing a product or service

- **short term capital** — capital that must be repaid within a year

- **small business** — business that is independently owned and not dominant in its field of operation; often businesses of less than 100 employees are considered small.

  According to the Small Business Administration, 95 percent of all businesses in the United States are small businesses, primarily in the retailing, wholesaling, construction, and service industries

- **Small Business Administration (SBA)** — federal agency established to assist small business owners

OBJECTIVE 2

Provided with a list of alternatives, select factors that contribute to the success or failure of a business.

- **Management**

  Ninety percent of small-business failures result from inexperience or poor management. A number of personal traits affect one's skills as a manager, including the ability to make decisions and give directions, the ability to get along with others, the ability to reorganize and plan, the willingness to take risks, and the ability to bounce back if those risks fail.

- **People**

  The success of a business is directly related to the people involved in its operation — not just the management personnel, but the entire staff. People who are skilled, honest, hard-working, and dependable can contribute greatly to the success of a business.

  Research affirmative action laws to ensure your business meets all the requirements for ethnic diversity and gender equity regulations.

- **Money**

  The new business owner quickly learns that every aspect of the operation revolves around careful management of the company's finances. Additionally, a company's success or failure depends on economic conditions in its local area and the country. Costs of materials, labor, and facilities, and the availability of capital to regulate business growth and its potential to make a profit.

Planning and controlling cash flow is critical to the success of a small business. Ensuring cash is available to pay bills or to purchase needed equipment and supplies is a key to the well being of a small business.

- **Market**

The success of a business depends on its offering a product that the public wants to buy at the price offered. A carpenter who sets up a cabinet making shop in a locality where all the construction companies build their own cabinets on the job site is likely to have a difficult time succeeding. Other marketing factors are advertising and selling. Good marketing approaches might convince the construction companies that they can get better quality cabinets at a lower cost and more effectively from the cabinet shop—leading to the success of the business.

OBJECTIVE 3 **Given a list of choices, select resources from which you may receive assistance in starting a business.**

- **Introduction**

Managers of small businesses frequently have had little experience in business management. Yet, because of the limited amount of resources, the success of a small business is generally more directly dependent on the manager making good decisions than it is in a large business where costly mistakes may have less effect on the overall success of the company. Additionally, large companies can afford to hire specialists to handle various phases of their operations, while the small business owner must make all the decisions and do all the planning. For these reasons, a number of agencies and organizations exist to help the small business owner.

- **Information Sources**
  - Federal government agencies

    EXAMPLES: Small Business Administration (SBA), Department of Commerce, Department of Labor, Federal Trade Commission, Government Printing Office, Internal Revenue Service

  - State governments
    - Department of Commerce
    - Vocational-Technical Education System
  - Chambers of commerce
  - Community business development councils
  - Business or trade associations

    EXAMPLES:
    - National Retail Merchants Association
    - National Federation of Independent Business
    - The Associated General Contractors of America
    - National Association of Home Builders
  - Credit bureaus
  - Better business bureaus
  - Associations of business people

    EXAMPLES: Rotary, Kiwanis, Association of Sales and Marketing Executives

  - Special libraries and information centers

- Business professionals

  EXAMPLES: Bankers, management consultants, Service Corps of Retired Executives, accountants, lawyers, insurance agents

- Personal contacts

  - Suppliers
  - Area business people
  - Customers
  - Educators

    EXAMPLES: High school, vocational schools, colleges and universities, business school, apprentice school

- **Management consultants**

  SBA management consultants offer advice on the kind of business to start, where financing may be available, how to obtain helpful training, and how to find solutions for management problems. The SBA is the most complete resource for starting a new business.

- **Loan administrators**

  The SBA makes loans for purchasing equipment and facilities, buying materials, and meeting other expenses related to starting a business

- **Contract locators**

  Contract locators assist small businesses in finding bid information on government contracts and in writing bids to get such contracts

- **Sources of Capital**

  Capital is the money required to operate a business. Expenses may be *fixed capital* or *working capital* expenses. Fixed capital expenses include money spent to buy tools, buildings, vehicles, and equipment. Working capital expenses consist of salaries, money spent to rent or lease equipment, taxes, insurance costs, and advertising.

  — Owned capital — Money belonging to the entrepreneur

  EXAMPLES: Personal savings, mortgages on personal property

  — Retained earnings — Company profits used to expand the company

  — Borrowed capital — money obtained from lenders such as from individual investors, banks, government (SBA), or finance companies

MARKET FACTOR: WHEN TO TAKE THE RISK

- ☐ Have you identified the market?
- ☐ Does there seem to be a construction market large enough for your business to compete successfully?
- ☐ Do you know who in your trading area will purchase your goods or services?
- ☐ Do you know the income, occupational, and housing patterns of these potential buyers of construction services?
- ☐ If previous businesses have failed, have you found out why they failed?
- ☐ Are other businesses that handle your type of products/services prospering in the neighborhood?
- ☐ Have you come up with a profitable volume estimate?
- ☐ Do you have a good safety plan?
- ☐ Is the exterior of your facility attractive or can remodeling at reasonable cost improve the exterior image?
- ☐ Have community business organizations given you a favorable report on the site and business district?
- ☐ Can you handle the initial investment required to start the business?

May be photocopied for student use.

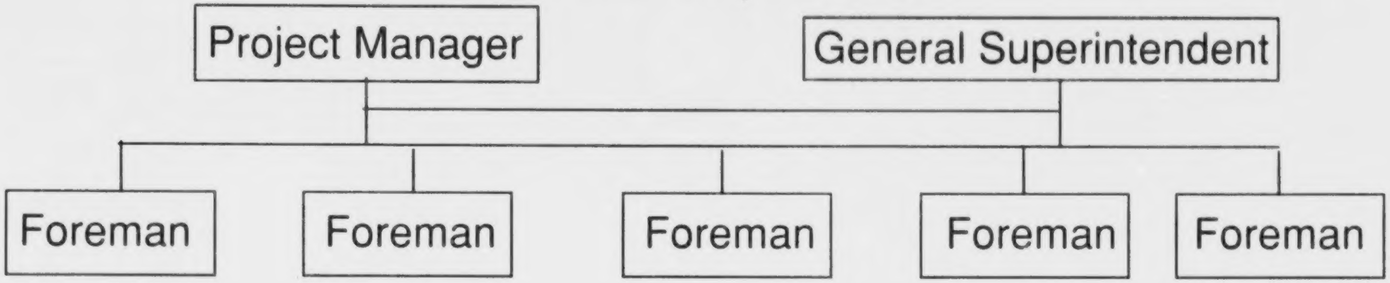
☐ Do the terms in your lease offer you protection against possible business failure and rising inflation?

☐ Will you be able to attract and retain employees with the skills needed for your business?

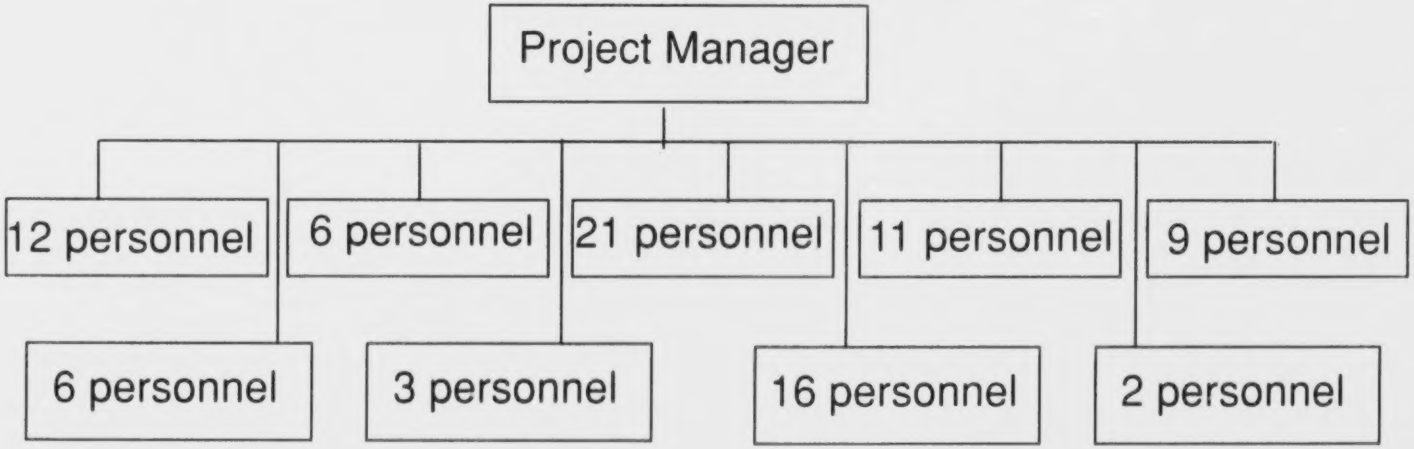
May be photocopied for student use.

Organizational Plans in Trouble

Potential Duplication


Project Manager
General Superintendent
Foreman
Foreman
Foreman
Foreman
Foreman

Too Many Reporting To One

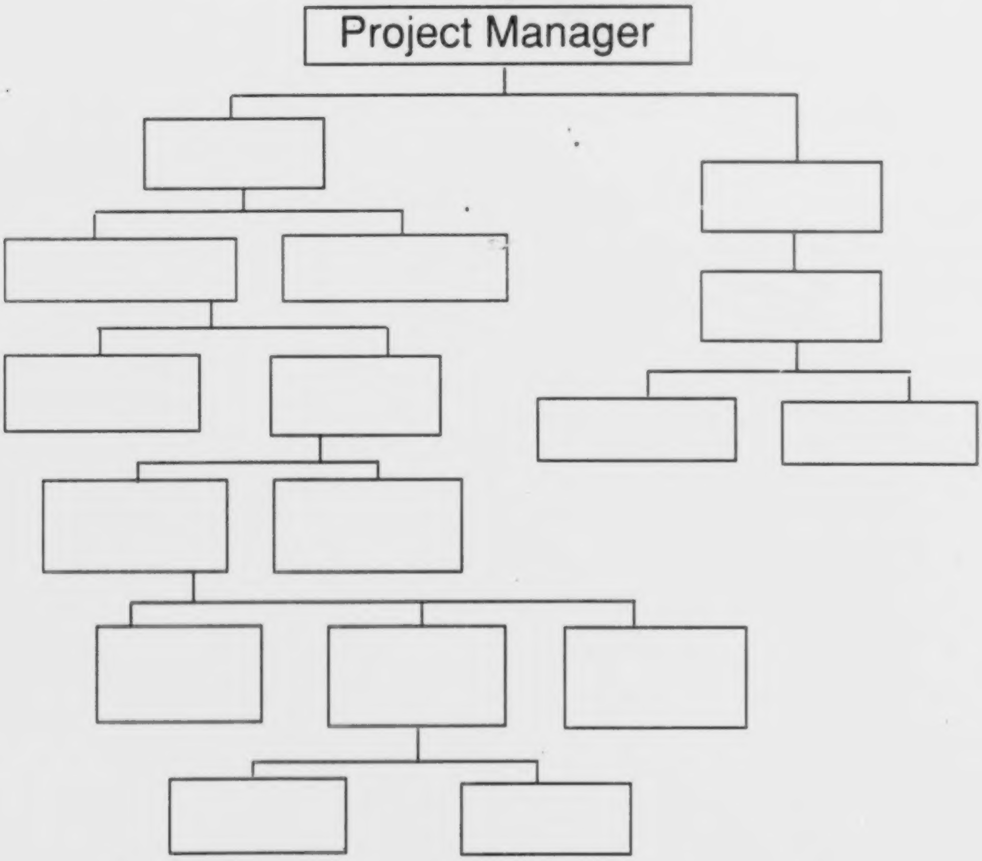

Project Manager
12 personnel
6 personnel
21 personnel
11 personnel
9 personnel
6 personnel
3 personnel
16 personnel
2 personnel

TRANSPARENCY MASTER 1 · Fundamentals of Construction
CIMC A2.15
vo-tech

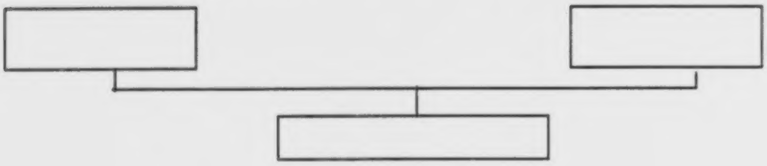
TM 1

Organizational Plans in Trouble (Continued)

Too Many Levels

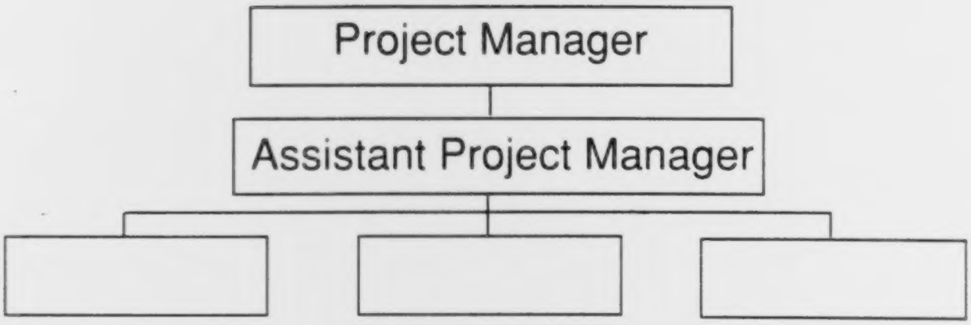


Reporting To More Than One Boss



Organizational Plans in Trouble (Continued)

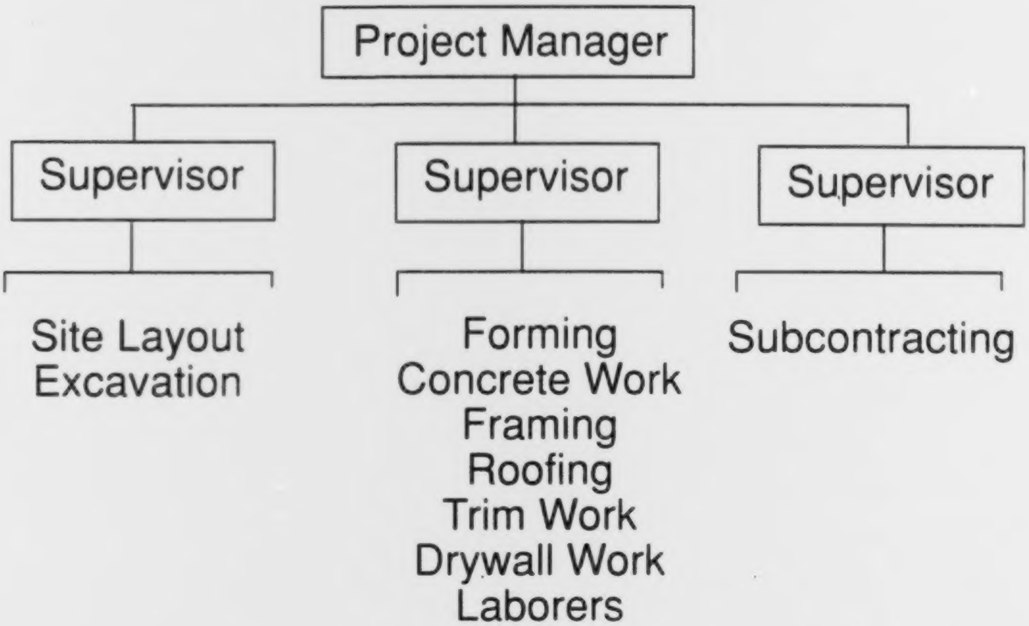
One Over One



Project Manager

Assistant Project Manager

Loads Out of Balance



Project Manager

Supervisor

Supervisor

Supervisor

Site Layout
Excavation

Forming
Concrete Work
Framing
Roofing
Trim Work
Drywall Work
Laborers

Subcontracting

votech

ASSIGNMENT SHEET 1

STARTING A CONSTRUCTION BUSINESS

A 2

Name ______________________________ Score __________

OBJECTIVE 4

Evaluate your potential to start a business.

INTRODUCTION

One of the most important things that prospective small-business owners can do to ensure business success is to have a good understanding of themselves. It is only through a close self-evaluation that individuals can identify their strengths and weaknesses and determine whether or not they are ready to go into business.

The questionnaire provided in this assignment should make you think about yourself, and about what you need to know to go into your own business. Depending on the type of business, one question may have more weight than another. A certain number of "Yes" or "No" answers, therefore, will not definitely indicate that you are ready to begin your own business. You should realize, however, that if these questions cause you to prepare yourself more thoroughly, you are less likely to have problems as you start your business.

INSTRUCTIONS

Read each statement in the following questionnaire. Write an "X" in the appropriate blanks.

Reading Comprehension Skills
- Distinguish fact, opinion and inference

Functional Reading Skills
- Follow written instructions

Functional
Writing Skills
- Complete forms and records

General
Relating Skills
- Identify personal values/attitudes
- Interact with clients/-customers/patients

PERSONAL CONSIDERATIONS

Yes	No	
_____	_____	Common sense is one of my strong points.
_____	_____	I like to make my own decisions and try my own ideas.
_____	_____	I enjoy being challenged and thrive on competition.
_____	_____	I have willpower and self-discipline. I get things done on time and plan ahead.
_____	_____	I like to work and understand that my own business will require me to work harder and longer —twelve to sixteen hours a day, probably six days a week, maybe even on holidays.
_____	_____	I have the energy to do all the work involved—lifting, hauling, working in a shop, standing, walking, talking, smiling, driving—that the day-to-day operation of this business will call for.
_____	_____	I realize that I cannot be all things to all people at all times but that this will be expected of me in my own business. I can withstand the strain such a situation will create for me.
_____	_____	I do not know everything. There are still things to learn, new ideas for me to consider. I can take advice from others.

Yes	No	
_____	_____	I am adaptable. I am not so routine-bound or rigid that I cannot change if the business requires change.

FINANCIAL CONSIDERATIONS

Yes	No	
_____	_____	I have a head for figures and have looked into my own—and the proposed business'—financial picture thoroughly, preparing all the necessary statements and projections with the help of my accountant, who will inform me of my financial progress.
_____	_____	I have enough money to go into business and can get more from other sources—friends, family, life insurance company. My banker stands ready to give me counseling and advice.
_____	_____	I know that I must repay my loan out of after-tax profits before I can see a return on my investment.
_____	_____	I know that it is possible for me to lose my savings—as well as the money I borrow from others—and that even if the business fails, I must pay back all that I owe.
_____	_____	I have always protected myself, my family, and my possessions with insurance and will continue to do so. My insurance agent will help me select the best protection for the business.

MARKETING CONSIDERATIONS

Yes	No	
_____	_____	I know that my community wants, needs, and can support this business and that there are enough people with sufficient inclination to spend money for the goods or services I plan to supply.
_____	_____	I have studied the strengths and weaknesses of my competition, and I know the marketable differences in my product or service.
_____	_____	I know how to go about finding the right location for my business and will select the site only after thorough research.

Yes	No	
_____	_____	I have given a good deal of thought to how and where I can best advertise and promote my products or services.

MANAGEMENT CONSIDERATIONS

Yes	No	
_____	_____	I realize that about 90 percent of business failures are caused by inexperience and poor management. I have several years' experience in this or a related business.
_____	_____	I know the methods a good manager can follow to improve a business and also the mistakes that can drive business away.
_____	_____	I am familiar with and know how to keep inventory records, record and report sales, withhold taxes for the government, and make out official employee and business records and forms.
_____	_____	I know that the employees are the vital link between the business and its smooth operation. My experience or education has prepared me for maintaining positive relationships with employees while obtaining results.
_____	_____	I realize I have a moral and legal obligation to provide equal employment opportunities regardless of gender or ethnic background. I know I must read and understand laws concerning equal opportunities.
_____	_____	I know how to develop an assistant or "backup" person to run the business when I am not there.
_____	_____	I know what the trade association expects of me and what to expect of it.
_____	_____	I can make my place of business safe, effective, and attractive—and stay within the budget.
_____	_____	I know the suppliers and the assistance they can provide.

Yes	No	
_____	_____	I know how to forecast income and expenses and how to use this information to help my business become successful.
_____	_____	I know how to price my goods or services competitively, meet expenses, make the payroll, and still turn a profit.
_____	_____	I know how to control my inventory or production to coincide with peak and slack periods in the business.
_____	_____	I know how to collect past-due accounts without losing customers.
_____	_____	I know how to analyze financial operating statements and can use these as a tool for effective business management.
_____	_____	I enjoy seeing my employees grow through increasingly greater challenges and responsibilities. I understand the benefit of empowering employees to make decisions and growing through teamwork and mutual respect.FINAL CONSIDERATIONS
_____	_____	I am aware of the advantages of working for someone else rather than going into business for myself and have considered all the alternatives to entering business on my own.
_____	_____	I know the advantages—and disadvantages—inherent in a sole proprietorship, partnership, and corporation and know which form of business organization I will select. My attorney will help.
_____	_____	I am aware that I may fail. There is a 50-50- chance that I will still be in business two years from now, but it is worth it to me to try.

ASSIGNMENT SHEET 2

STARTING A CONSTRUCTION BUSINESS

A 2

Name ______________________________ Score __________

OBJECTIVE 5

Examine expenses involved in starting a business.

INTRODUCTION

Many construction workers go into business for themselves. They may accept a subcontract to do work on a project, may act as the primary contractor, may build structures without a contract and hope to sell the buildings, or may start a company in a related area such as construction equipment or building materials. With all these opportunities, many carpenters are tempted to start their own businesses early in their careers without realizing the kinds of expenses and problems that an entrepreneur may encounter.

This assignment sheet provides you with the opportunity to study a business in the field of carpentry to become acquainted with the expenses involved in such business. Your instructor will help you obtain the resources necessary to complete this assignment.

INSTRUCTIONS

Using the case study provided, complete the questions to examine expenses of starting a business.

Research and Reference Skills
- Locate resources

Functional Reading Skills
- Follow written instructions

Math Application Skills
- Solve word problems

Data Analysis and Display
- Collect/record data

Functional Math Skills
- Solve income/expense problems

Cognitive Activity Skills
- Identify critical elements/issues

- Operating a Lumberyard

A. You have decided that you would like to start a retail business to sell building materials. One of your first needs is to find a location for your business, and you may have several choices of facilities. For example, you may be able to rent or lease an existing lumberyard, or you may be able to buy an existing lumberyard, with or without merchandise. Another possibility is that you can find some land on which you can build a lumberyard. Frequently, undeveloped land is available for sale or for lease, with the owner willing to build facilities to suit the buyer or lessee. Of course, in choosing any site you will also have to consider whether the location is zoned for the business that you are planning and whether it is a good location in terms of attracting customers and receiving deliveries from suppliers. Check with existing lumberyards and with real estate agents to find a suitable location for your business so that you can answer the following questions.

1. What locations are available to you? Check those available.

   ☐ Existing lumberyards for sale

   ☐ Building site for sale

   ☐ Existing lumberyard for rent or lease

   ☐ Building site for rent or lease

2. What would be the approximate cost of buying an existing lumberyard or building your own facilities?

   Total cost ________________________________

   Approximate monthly payments ________________

3. What would be the cost of renting or leasing a location complete with necessary facilities, either existing or built to suit your needs?

   Monthly cost to rent or lease ____________________

4. Will you be able to support yourself while waiting for facilities to be built or readied for business? Explain.

   ____

5. Considering your answers to the preceding questions, what would be your choice of locations for your lumberyard? Why?

   ____

   ____

B. Now that you have some idea of the lumberyards available in your area, and the options for locations and their costs, your next step might be to contact the Small Business Administration for some help and information. The SBA can discuss your plans and advise you as to whether the idea is worth trying and how you should approach the business. Contact your local SBA or a similar organization to discuss starting a building materials business in the locations you have considered. You might want to answer some of the following questions during your discussion.

_____ 1. How many businesses sell lumber in your marketing area?

_____ 2. Would your plans increase that number or leave it unchanged—that is, will you be replacing one of the businesses by renting or buying its facilities?

_____ 3. What is the total dollar value of sales made by all such businesses in your area per year? Per month?

_____ 4. Assuming that all other things were equal, what would be the proportional amount of business that you could expect to attract each month?

_____ 5. What would be the approximate cost of merchandise needed to start the business?

_____ 6. How much would have to be paid toward the merchandise during the first three months of business?

NOTE: A number of materials suppliers will deliver the materials and bill you later. In this way, you may have thirty days or more before you have to pay for any merchandise.

_____ 7. What other expenses are likely? How much would they run per month?

_____a. Salaries and benefits

_____b. Utilities

_____c. Advertising

_____d. Office supplies

_____e. Dues (trade associations, chamber of commerce)

_____f. Taxes

_____g. Insurance

_____h. Equipment

_____i. Professional services (legal, accounting)

_____j. Facilities maintenance

_____k. Other — ____________________

____

8. In light of monthly expenses, your realistic expectation of income, and your need to make some profit, is it a good idea to start a lumberyard in the location you have chosen or in your area at all? Why?

____

____

9. Are other construction-related businesses good choices? If so, what and why?

____

____

Name ____________________ Score __________

OBJECTIVE 6

Explore challenges faced by entrepreneurs in operating a business.

INTRODUCTION

Starting and operating a business is a complicated undertaking that can lead to rewarding success or disappointing failure. Usually the failures are a result of poor planning or inadequate preparation. Often it is difficult to prepare for some of the situations that you may face because businesses are subject to the rise and fall of the economy, good and bad weather, support or lack of support from other businesses, fair and unfair treatment by individuals, and many other factors.

In this assignment sheet you will be presented with several case studies of businesses in trouble. The problems generally result from one of the factors discussed in the information sheet that contribute to the success or failure of a business. Part I of this assignment sheet discusses those factors further. Read the material in Part I, and then go to the case studies in Part II. For each problem, identify the factor or factors that led to the problem. Then suggest a way the problem might have been avoided, such as by suggesting an agency that could have helped the entrepreneur prepare for the problem.

INSTRUCTIONS

Read the information provided and respond to the questions in Part II, Case Studies.

Functional Reading Skills

- Follow written instructions

PART I

General Relating Skills
- Apply information to life experiences

Leadership/ Influencing Skills
- Analyze/apply management styles

Cognitive Activity Skills
- Identify critical
- Evaluate results/ outcomes

A. Management factors

1. Personal qualifications

   It is doubtful that a person would possess all of the personal qualifications desirable for good management. However, a person may build on strong areas and try to improve the weak ones. Weak areas can be improved by attending conferences and courses, reading literature in these areas, and observing those with strong qualifications.

   a. Willingness to work long hours

   b. Desire to learn

   c. Ability to bounce back after a setback

   d. Willingness to take risks

   e. Ability to get along with others

   f. Ability to communicate

   g. Ability to sell

   h. Ability to lead

   i. Ability to make decisions

   j. Ability to organize

2. Professional qualifications

   a. Management knowledge

   b. Technical knowledge

c. Ability to develop plans and objectives

1) Financial planning

A good financial plan should provide profit objectives, sales objectives, and projected major expenses.

2) Organizational planning

An effective organizational plan allows for maximum productivity with little or no duplication of effort.

3) Projects and activities planning

Every small business must take time to plan for the future, prepare necessary schedules and procedures, and make decisions about new activities that should be started.

B. People factors

1. Recruiting, interviewing, and selecting personnel

a. Recruiting sources

EXAMPLES: State employment services, private placement services, educational facilities, general public, industry groups

b. Interviewing skills

These skills determine how well a business can select the best employees from those available in the labor market.

2. Personnel practices

These practices determine to a large part how people will be motivated to devote their full capabilities for the benefit of a business.

a. Pay and fringe benefits

EXAMPLES: Holidays, life insurance, sick leave, vacation, health insurance, retirement

b. Working conditions

c. Affirmative action programs

d. Grievance procedures

e. Positive discipline

f. Administrative procedures

EXAMPLES: Keeping payrolls prompt and accurate; keeping employees informed about fringe benefits; assisting employees in filing of health insurance claims and worker's compensation claims; scheduling vacations; organizing work

g. Training

C. Money factors

1. Capital and sources

Rarely does an owner or group of owners have enough money to conduct all the affairs of a business. For this reason, people must borrow money. Sources of money beyond personal savings include banks, savings and loan companies, the Small Business Administration, and private investors.

2. Financial management

a. Analysis of financial statements

EXAMPLES: Income statement, expense statement, balance sheet

        b. Tax management

    3. Pricing and credit

    Pricing has a great influence on the volume of business and on the profitability of that volume; credit when closely controlled can be used to increase sales, open markets to new buyers, facilitate selling, and satisfy customers.

    4. Budgets, cost controls, and records

    These items must include labor cost by operation, material cost, waste, damage, scrap, and markdowns if the business is to record profit or loss accurately.

D. Market factors

    1. Market and market objectives

        a. Analysis of the product or service

        b. Definition of the market

        c. Sources of supply

        d. Competition

        e. Location

        f. Layout

    2. Marketing plan

        a. Direct sales effort

        In a business where customers come to buy the product, it is important to train salespeople properly so that they know the product and how to approach customers. In a business where sales are achieved by contacting customers outside the business, it becomes important to decide whom to see, in what order, and how much effort to spend on each customer.

b. Advertising and promotion

Advertising and promotion can be very useful in attracting customers to the goods or services offered by a business. However, it may be expensive and should be carefully organized so that it will reach the public with the right message at the right time. Advertising must also occur frequently enough so that the desired results will be achieved.

PART II — Case Studies

A. Joe Bryan has decided to build homes on speculation. He has purchased a lot and begun construction of a house. One evening after Joe's crew has gone home, a group of children begin playing on the construction site. A ten-year-old boy falls through a cutout in the roof decking that was made for a skylight. The little boy breaks his back, and his parents sue Joe for $350,000 for medical damages, pain and suffering, and mental anguish. It is quite possible the court will rule against Joe.

Factor ______________________________________

Help ____

____

B. Alice Muggendorf has always wanted to live in the mountains. She decides one day to relocate her construction company to Colorado to take advantage of a building boom for condominiums near the ski areas. She chooses the town of Glacierview because it is within 50 miles of several ski areas, and she figures that most skiers would be willing to drive for an hour to ski. Also, a check of the Glacierview phone directory shows that there are no condominiums in the area. However, on arriving in Glacierview, Alice discovers that the steep winding roads make it at least a three-hour drive to any ski areas and that several of the passes are closed for most of the winter.

Factor ______________________________

Help ______________________________

____

ASSIGNMENT ANSWERS — STARTING A CONSTRUCTION BUSINESS — A 2

ASSIGNMENT SHEET 1

This is a self evaluation of your potential to start a business. You may wish to discuss your strengths and weaknesses with your instructor.

ASSIGNMENT SHEET 2

Evaluated to the satisfaction of the instructor.

ASSIGNMENT SHEET 3

Case Studies (Part 2)

A. **Factor** — Management; Joe has demonstrated his willingness to take a risk. His ability to bounce back from a setback will be tested through this situation.

Help — Liability insurance would help in this situation. It is hoped that Joe has properly managed his business and invested in liability insurance.

B. **Factor** — Marketing; though Alice should have exercised better judgment as a manager by investigating the business move more thoroughly, her real problem results from a lack of a market for condominiums in the area. Alice assumed that such a market existed and ran into trouble when she relocated only to find that her condominium business will probably not be able to succeed in Glacierview.

Help — A number of agencies and private businesses provide marketing studies to entrepreneurs. The SBA, chambers of commerce, local and state development agencies, and other organizations could have provided Alice with an accurate assessment of her chances of success.

STARTING A CONSTRUCTION BUSINESS

Name ______________________ Score ________

OBJECTIVE 1

Given a list of terms associated with starting a business, match them to their correct definitions. Write the letter that corresponds to the most correct answer in the blank.

_____ 1. A person who owns a business is most often called a/an:

- a. entrepreneur
- b. employee
- c. manager
- d. lessee

_____ 2. What is the term used to define the money left after subtracting all the costs involved with providing a product or service?

- a. Total cost
- b. Capital
- c. Expense
- d. Profit

_____ 3. Which of the following terms describe the capital that must be repaid within one year?

- a. Long-term
- b. Short-term
- c. Collateral
- d. Short-cap

_____ 4. Tools, machines, and vehicles can be assigned to a lender as a pledge of debt payment and are called:

- a. short-term capital
- b. collateral
- c. profit
- d. debt

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_____ 5. Insurance that protects your business when customer injuries are caused by an employee of your business is called __________________ insurance.

a. consumer
b. customer valued
c. liability
d. inventor

_____ 6. What is the best term for the movement of money into and out of a business?

a. Profit
b. Expenses
c. Salaries
d. Cash flow

_____ 7. What is the term to describe a contract to use an item without purchasing it?

a. Lease
b. Collateral
c. Franchise
d. Buy clause

_____ 8. The rivalry among sellers for consumers' dollars is called:

a. short-term capital
b. competition
c. marketing
d. merchandising

_____ 9. Which of the terms below describe a legal agreement between a parent company and a distributor to sell products or services?

a. Marketing clause
b. Merchant
c. Entrepreneur agreement
d. Franchise

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_____10. Which of the following terms describe federal laws to provide equal employment opportunities for women and ethnic minorities?

a. Positive employment
b. Equal pay
c. Affirmative action
d. Ethnic parity

OBJECTIVE 2 **Provided with a list of alternatives, select factors that contribute to the success or failure of a business.**

_____ 1. What is the largest factor causing businesses to fail?

a. Inexperienced or poor management
b. Lack of skilled employees
c. Poor quality products
d. Poor marketing

_____ 2. The success of a business is directly related to the _______________________ involved in its operation.

a. equipment
b. tools
c. facilities
d. people

_____ 3. Planning and controlling __________________ is critical to the success of a small business.

a. cash flow
b. office supplies
c. zoning laws
d. federal employment regulations

_____ 4. Convincing a construction company that they can get better quality cabinets at a lower cost from your company requires good __________________ approaches.

a. planning
b. risk taking
c. marketing
d. capital investment

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OBJECTIVE 3 **Given a list of choices, select resources from which you may receive assistance in starting a business.**

_____ 1. One of the most complete resources of information to start a new business can be found at:

a. the SBA
b. local contractors
c. post offices
d. your local bank

_____ 2. Where within your *state* government might you receive assistance in starting a new business?

a. Department of Human Services
b. Department of Tourism
c. Department of Commerce or your vocational-technical educational system
d. Department of Transportation or your vocational technical educational system

_____ 3. What is(are) common *local* source(s) of assistance in planning a new business?

a. Business professionals
b. Personal contacts
c. Chambers of Commerce
d. All the above

_____ 4. Where is a likely source of capital to start a new business?

a. Owned capital
b. Investors
c. Government loans
d. All the above

NOTE: Objectives 4-6 are evaluated through completion of the assignment sheets.

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WRITTEN TEST ANSWERS

STARTING A CONSTRUCTION BUSINESS

A 2

OBJECTIVE 1

1. a
2. d
3. b
4. b
5. c
6. d
7. a
8. b
9. d
10. c

OBJECTIVE 2

1. a
2. d
3. a
4. c

OBJECTIVE 3

1. a
2. c
3. d
4. d

OBJECTIVE SHEET — *ORIENTATION TO CONSTRUCTION SAFETY* — B 1

INTRODUCTION

The importance of safety cannot be stressed enough, particularly as related to the construction trades. Studies show there is a much greater risk for injury when students become comfortable in performing skills because they tend to become more careless. Safe practices and habits may prevent injuries, loss of equipment, loss of materials, and may even save lives. BE CAREFUL, THINK SAFETY.

UNIT OBJECTIVE

After completing this unit, the student will be able to practice safety on the job. The student will show this knowledge by completing assignment sheets, job sheets, and written test with a score of 100 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to:

1. Given a list of safety terms, match them to their correct definitions.
2. Choose appropriate reasons for safety consciousness on the job.
3. Select from a list of alternatives, consequences of workers using controlled substances on the job.
4. Given proper and improper safety precautions, choose the correct alternative.
5. Given a color code, match colors to their correct safety application.
6. Provided a list of terms associated with toxic substances, select their correct definition and exposure consequences.
7. Given alternatives, select the correct reasons for the use of Material Safety Data Sheets (MSDS).

8. Given a picture, identify personal safety equipment and their purpose.

9. Identify job-site safety violations. (Assignment Sheet 1)

10. Match types of fire extinguisher symbols to their given classes of fires. (Assignment Sheet 2)

11. Properly lift a heavy object. (Job Sheet)

SUGGESTED ACTIVITIES

ORIENTATION TO CONSTRUCTION SAFETY

B 1

PREPARATION

- Review unit and plan presentation.
- Order or obtain materials listed in suggested resources.
- Invite speakers from OSHA and other construction trade associations to discuss their safety programs.

DELIVERY

Objective 1: Given a list of safety terms, match them to their correct definitions.

- Explain how knowing the terms and definitions will help the student understand and grasp the importance of this unit.
- Show a film on HAZCOM titled "Hazard Communication: The System That Works" from AGC of America.

Objective 2: Choose appropriate reasons for safety consciousness on the job.

- Discuss how important it is to you and to your family, friends, co-workers, and employer that you be safety conscious on the job.
- Have each student make a list of all the people who could be affected if an injury occurred to him or her while on the job. Then discuss how an injury to the head of a household could affect the future of each family member.

Objective 3: Select from a list of alternatives, consequences of workers using controlled substances on the job.

- Explain that alcohol or drug use on the job cannot be tolerated by employers because a drug or alcohol user becomes a safety threat to themselves and to fellow workers.
- Explain the financial consequences of alcohol and drug use to the worker, to his or her family, and to the worker's company.

- Quote appropriate statistics to support the ideas you have presented.

- Make available to your students copies of the AGC publication *Guide to Drug-Free Jobsites*. Discuss in class.

- Show the AGC videotape Drug-*Free Workplace*.

Objective 4: Given proper and improper safety precautions, choose the correct alternative.

- Discuss OSHA and other regulatory acts and agencies.

- Show films *Safety in the Shop: Basic Practices, Housekeeping Means Safe Keeping*, and *How to Avoid 16 Leading Causes of OSHA Citations*.

- Demonstrate any safety procedures and explain any safety policies applicable to your specific equipment, shop, or job site.

- Ask students to explain why personal and job-safety rules are important. Have them list possible consequences of not following these rules.

- Stress the consequences of practical jokes on the job. Point out that employers do not want cheerless or humorless workers, but that they do want responsible employees who know the right time and place for humor. Explain how some people have lost their jobs because they engaged in horseplay or played practical jokes during working hours.

- Explain how horseplay and practical jokes around power equipment increase the possibility of accidents.

- Set up work schedules and shop clean-up procedures, and explain schedules and procedures to students. Post these schedules and procedures on the bulletin board.

- Explain procedures for disposing of waste and scrap materials.

- Discuss proper use of cleaning equipment and supplies, explaining special cleaning procedures or techniques specific to your equipment or shop.

- Discuss precautions for the use of scaffolds and ladders listed in the information and have students study them. Show students copies of OSHA regulations pertaining to scaffolds and ladders.

- Supplement your discussion with Transparency 2, "Ladder Safety," and 3, "Ladder Danger."

- Discuss the one-call system for excavations. This is a system to which many companies with underground facilities subscribe. When calling this "800" number, you should give the following information:

  - Where you plan to dig
  - When you plan to start and finish
  - Type and depth of excavation
  - Nature of the work and if there will be blasting
  - Your name and the company you are doing the work for
  - Phone number and the best time to reach you

After your call, all companies that have underground utilities in this section will be informed, and they in turn will go to the property and mark their facilities with yellow flags or some other type markers. Try to give the one-call system at least 48 hours notice.

- Discuss and stress the importance of safety pertaining to excavations, especially trenches.

- Explain how sloping the sides of trenches and shoring will make the excavation safer.

- Use Transparencies 4 through 6 to supplement your discussion.

- Discuss angle of repose (amount of slope needed on sides of excavations) for different depths and types of soils and how presence of ground water or seepage requires special treatment.

Objective 5: Given a color code, match colors to their correct safety application.

- Ask if anyone in the class is color blind (unable to distinguish between certain colors such as red and green). Take color blind students on a special tour of the shop and work area, pointing out specific locations and applications for safety colors.

- List colors of the safety color code, and have students find and list applications of each in the shop and at the work site.

Objective 6: Provided a list of terms associated with toxic substances, select their correct definition and exposure consequences.

- Explain how knowing these terms and definitions will help the students understand and be more aware of toxic substances and the importance of the safety rules pertaining to toxic substances.

- Explain to the students the forms of toxic substances workers commonly encounter on the job, and also how these substances may still be toxic, even when changed from their common form. For example, solids such as cement and asbestos are just as toxic when inhaled as airborne dusts.

- Discuss how dust, gases, fumes, vapors, and mists can all be very dangerous when they enter the body through breathing, through the skin, or through open sores. Explain how some toxic substances may enter the body by settling on foods, drinks, and cigarettes, pipes, or cigars.

- Explain how some toxic gases are easily detected by their distinctive smell or color, while some toxic gases have no smell or color.

- Explain the different types of radiation that may be found on the job. Examples are ultraviolet light, infrared rays, X-rays, microwaves, and lasers. All of these are especially hazardous to the eyes. Warn students about these hazards, especially when working with or near welding procedures.

- Take students on a field trip to a large construction site. Have them make a list of all the toxic substances they see plus any items that could be potential hazards if changed to another form, such as burning polyurethane foam.

- Explain ways toxic substances enter the body, the effects of toxicity.

- Explain how the body quite often rids itself of toxins through sweat, breath, phlegm, vomit, sneezing, urine, and feces.

- Discuss with the students how they may recognize symptoms of illness that result from exposure to toxic substances. Symptoms include headaches, itching, coughing, and loss of appetite.

- Explain how some chemicals may only affect the bodily areas they contact, while other chemicals may penetrate into one area of the body and then affect other bodily systems.

- Discuss how most of the internal organs and the external organs—the skin, eyes, nose, and throat—can be damaged by toxic materials.

- Explain how lack of knowledge of toxic substances could be very dangerous to the student. By paying attention, students may save themselves and others from very painful and dangerous situations.

- Supplement your discussions with audiovisual programs on chemical hazards.

- Hand out copies of Supplement 3.

Objective 7: Given alternatives, select the correct reasons for the use of Material Safety Data Sheets (MSDS).

- Discuss the importance of MSDS and the benefits of having them on the job for everyone to read.
- Discuss the benefits of reading and knowing the results that could take place around hazardous chemicals.
- Stress the importance of students reading the MSDS before working with any particular hazardous chemical.
- Discuss the importance of wearing proper safety equipment when working with or around hazardous chemicals.

Objective 8: Given a picture, identify personal safety equipment and their purpose.

- Discuss safety equipment and their uses.
- Emphasize the importance of using proper safety equipment correctly..
- Explain to the students that personal safety equipment was designed to create a barrier against work place hazards; therefore, it is their duty to use this equipment and use it properly.
- Point out that using the wrong safety equipment could be more dangerous than not using any. Use the right equipment for the job being done.

APPLICATION

Objective 9: Identify job-site safety violations. (Assignment Sheet 1)

- Use Assignment Sheet 1 to give students practice in identifying job-site safety violations.

Objective 10: Match types of fire extinguisher symbols to their given classes of fires. (Assignment Sheet 2)

- Use Assignment Sheet 2 to give students practice in learning to identify fire extinguisher symbols and to be able to match the correct types extinguishers to different classes of fires.
- Stress the importance of knowing the different classes of fires and the correct type of fire extinguisher to use for each.
- Supplement your discussion with Transparencies 7 through 9.
- Have students locate and read the labels on each of the fire extinguishers in the shop area, listing the class or classes of fire each should be used on.
- Invite a fire-fighter to the class to explain and to demonstrate the proper use of the various types of fire extinguishers.
- Have students practice selecting the correct fire extinguisher by completing Assignment Sheet 2, "Match fire-extinguisher symbols to their given classes of fires."

Objective 11: Properly lift a heavy object. (Job Sheet)

- Show student Transparency 1, "Correct Way to Lift Heavy Objects," and Supplement 1, "How to Lift Safely."
- Use Job Sheet 1 to provide students an opportunity to develop the skills for properly lifting heavy objects.

EVALUATION

Pretest

- Give written test as pretest.
- Determine individual study requirements from pretest results.
- Counsel students individually on pretest results and study requirements.

- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.
- Evaluate students on job sheet activities.
- Complete appropriate section of competency profiles.
- Reteach and reevaluate if necessary.
- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Evaluate students on assignment sheet activities.

  NOTE: The written test may be given in sections if desired.

- Give the written test.
- Reteach and retest if necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Electronic Media

Write or call the following companies for the most current films and/or publications on safety.

- AGC Safety Videos

Pub. #	
112	*The System That Works* — Hazard Communication Training Videocassette and Instructor's Manual
131	*Controlling The Field: Jobsite Safety Inspections*
132	*Just The Facts: Accident Investigation*
133	*Cleaning The Air: Confined Space Entry*
134	*Success At The Top: Stairway and Ladder Safety*
135	*The Choice Is Yours — AGC Guide to Personal Protective Equipment*
136	*On Solid Ground: A Plan for Safe Excavation and Trenching*
137	*Take Charge: Working Safely With Temporary Electricity*
138	*The Winning Ticket: Housekeeping On The Jobsite*
139	*Safety: The Bottom Line*
141	*Caught In Time: Fall Protection in Construction*
142	*Play It Safe—An Overview Of Crane Safety*
143	*The Rules Of The Game—Employee Safety Orientation*
144	*Handle With Care: Jobsite Hazardous Waste Safety*
145	*Exposing the Facts: Lead Exposure in the Construction Industry*
159	*Think Again: Substance Abuse on the Jobsite*
180.1	*Fire Extinguisher Operation*
180.2	*Eye and Face Protection*
180.3	*Compressed Gas Safety*
180.4	*Hand Protection*
180.5	*Foot Protection*
180.6	*Hearing Protection*
180.7	*Ladder Safety*
180.8	*Working Safely on Scaffolds*
180.9	*Working Safely with Crane Rigging*
180.10	*Powder Actuated Tool Safety*
180.11	*Chemical Safety*
180.12	*Working Around Construction Equipment Safely*
180.13	*Working Safely Around Explosives*
180.14	*Construction Equipment Maintenance*
180.15	*Safety Belts for Vehicle Safety*
180.16	*Traffic Control*
180.17	*Carbon Monoxide Safety*
180.18	*Warning Signs*
180.19	*Working Around High Voltage*
180.20	*Head Protection*

Name ______________________ **Subtotal $** __________
Company ______________________ **Florida & D.C.:**
Type of Work ______________________ **Add 6% sales tax $** __________
Street Address ______________________ **Grand Total $** __________
City ______________________ State __________ Zip __________
Phone ______________________

CHECKS: Payable to AGC **CREDIT CARDS:** ☐ **Visa** ☐ **Master Card** ☐ **American Express**
Card # ______________________ Expiration Date, mo./yr. __________
Name as printed on card ______________________ Signature ______________________
THE ASSOCIATED GENERAL CONTRACTORS OF AMERICA
PUBLICATIONS DEPT., 1957 E STREET N.W., WASHINGTON, D.C. 20006-5199 • FAX: (202) 737-5011

- National Audio Visual Center, National Archives and Records Administration, Customer Services Section CL, 8700 Edgeworth Drive, Capital Heights, Maryland 20743-3701.

- National Safety Council, P.O. Box 11933, Chicago, Illinois 60611. (312) 527-4800.

- Oklahoma Department of Vocational and Technical Education, Resource Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074-4364, (800) 522-5810. (Films from the State Department are available on a free-loan basis to Oklahoma teachers only.)

- Underwriters Laboratories, Inc., Public Information and Education Services, 207 East Ohio Street, Chicago, Illinois 60611.

Publications

- American Association for Vocational Instructional Materials, Engineering Center, Athens, Georgia 30602. Phone 1-800-228-4689.

- Fire Protection Publications, Oklahoma State University, Stillwater, Oklahoma 74078. 800-654-4055.

- National Audio Visual Center, National Archives and Records Administration, 8700 Edgeworth Drive, Capital Heights, Maryland 20743-3701.
- National Safety Council, 444 North Michigan Avenue, Chicago, Illinois 60611. 312-527-4800.
- Underwriters Laboratories, Inc., Public Information and Education Services, 207 East Ohio Street, Chicago, Illinois 60611.
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UNIT REFERENCES

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OBJECTIVE 1

Given a list of safety terms, match them to their correct definitions.

- **accident** — any suddenly occurring, unintentional event that causes injury or property damage
- **carelessness** — failure to think before one acts; failure to pay attention
- **combustible** — capable of bursting into flames
- **confined entry** — areas such as vaults, tanks, sumps, and excavations where space is limited
- **explosive** — tending to blow up or burst violently and loudly
- **extinguish** — to put out a fire; to cause to cease burning
- **flammable** — capable of being easily ignited; burning extremely rapidly
- **hazard** — source of danger
- **HAZCOM** — Hazard Communications; an OSHA program that requires employers to develop specific written programs for job site safety.
- **MSDS** — Material Safety Data Sheets used to inform personnel of hazardous chemicals
- **MSHA** — Mine Safety and Health Administration
- **NIOSH** — National Institute for Occupational Safety and Health
- **OSHA** — Occupational Safety and Health Act; federal legislation designed to ensure safe and sanitary working conditions for employees

- **personal protection equipment** — goggles, hard hat, gloves, respirators
- **pressurized** — pressure greater than the pressure of the atmosphere
- **safety** — freedom from danger, risk, or injury

OBJECTIVE 2 **Choose appropriate reasons for safety consciousness on the job.**

- Responsibility to yourself to think before you act and to stay alert and aware of where you are in order to prevent personal injury
- Responsibility to your family members to continue providing for them and to keep them safe
- Responsibility to your co-workers to prevent accidents from happening to them by being concerned with their safety and welfare and by encouraging them to be safety conscious
- Responsibility to your employers to prevent accidents so that they are not shorthanded, their job progress is not slowed down or stopped, and their insurance rates are not increased, making them less competitive

OBJECTIVE 3 **Select from a list of alternatives, consequences of workers using controlled substances on the job.**

- Increases safety hazard to worker and to co-workers
- Causes worker to be tardy or absent
- Causes worker to neglect duties and be less productive
- Will cause worker to lose job
- Drives up cost of production and cost of insurance, making employer less competitive

OBJECTIVE 4

Given proper and improper safety precautions, choose the correct alternative.

General safety

- Be familiar with location of fire-fighting and first-aid equipment.
- Be alert and conduct yourself in a manner that will ensure safe practices.
- Be conscious of others' safety and encourage others to do the same.
- Report all accidents, regardless of nature or severity, to the supervisor.
- Observe all of OSHA, NIOSH, MSHA, and job-project safety rules.
- Be certain ample ventilation is provided in areas where hazardous vapors may by present.

Personal safety

- Remove rings and other jewelry when working.
- Confine long hair before operating power equipment.
- Wear close-fitting clothing appropriate for activity being performed.
- Wear safety shoes or boots, gloves, and hard hat.

  NOTE: All protective and safety equipment must be OSHA-approved.

- Wear face and eye protection as required.

  EXAMPLES: Safety glasses, goggles, and face shields

- Wear ear protection as required.

  EXAMPLES: Earplugs and earmuffs

- Wear respiratory protection approved for the contaminant you will be exposed to.

  EXAMPLE: Dust respirator, paint respirators

  NOTE: On jobs where it will be necessary for workers to wear respirators, respirator cleaning and storage facilities must be provided, medical examinations must be given to workers using the respirators, and a formal program is necessary to train workers in selecting the correct respirator, in making sure that the respirator fits properly, and in proper procedures for using and maintaining the respirator..

- Wear fall protection when needed.

- Protect exposed skin.

  EXAMPLES: Skin cream, body lotion, petroleum jelly, or sunscreen

- **Never** use compressed air to clean clothes or person.

- **Do not** carry sharp tools in your pockets.

- Practice personal hygiene.

  EXAMPLES: Bathe and change your clothes on a regular basis; change your gloves often (especially if they are wet); change your shoes if they get wet; clean the band inside your hard hat; remove clothing as soon as possible if it is soaked with gasoline or solvents.

Equipment and tool safety

- Obey all safety rules, and observe limitations on equipment according to specifications and manufacturer's requirements.

- Maintain all tools in a safe working order, and properly store tools when not in use.

- Retain guards and safety devices on all equipment.

- Tag and report to the supervisor any defective tools, machines, or other equipment.

- Be sure to shut off all power equipment when finished with it, and **do not** leave equipment until it has stopped completely.

- Operate equipment only after receiving instructions on how to operate it safely.

- Disconnect power from equipment before changing accessories and before performing service or maintenance.

- Use the correct tool for the job for which it was intended.

- Clean chips from grinders and other equipment with a brush; **do not** clean equipment with your hands or with a rag; **do not** clean equipment while it is running.

Work area safety

- Arrange equipment to permit safe, efficient work practices and ease of cleaning.

- Store materials and supplies safely in their proper places.

- Store tools and accessories safely in cabinets, on racks, or in suitable storage areas.

- Keep work area clear of debris and other hazards.

- Always remove nails from wood prior to storage or disposal.

- Clean floors of obstructions and slippery substances; clean up spills immediately.

- Keep aisles, exits, and traffic areas free of materials and debris.

- Dispose of combustible materials properly.

- Keep sufficient brooms, brushes, waste containers, and other housekeeping equipment readily available.

Flammable-liquid safety

- Carefully read labels on all flammable liquids, and use flammable liquids only in open, well-ventilated areas.

  NOTE: Be cautious to prevent inhaling or igniting fumes from flammable liquids.

- Be sure that all flammable liquids are marked correctly for storage.

- Store all flammable liquids properly and only in approved safety containers.

  NOTE: Oily rags and flammable materials should be stored in metal containers with self-sealing lids.

- When clothing is soaked by a flammable liquid, immediately change clothing and cleanse body with appropriate cleaner.

- Use flammable liquids only for their intended purposes.

  EXAMPLE: **Never** use gasoline as a cleaner.

- **Do not** use flammable liquids near fire or flame.

- Always be aware of the location of appropriate fire extinguisher.

- Stop, drop, and roll to smother fire; **never** run.

Gasoline-powered equipment safety

- Use caution to prevent contact with hot manifolds and hoses.

- Be sure that equipment is out of gear before starting.

- Always keep appropriate fire extinguisher near when starting and operating gasoline-powered equipment.

- **Do not** pour gasoline into carburetor or cylinder head when starting engine; use recommended starting fluid.

- **Never** pour gasoline into fuel tank when engine is hot or when engine is running.
- **Do not** operate equipment that is leaking gasoline.
- Stop, drop, and roll to smother fire; **never** run.

Materials handling safety (cement, concrete, organic solvents)

- Use good work practices to reduce dust in the air when handling cement and concrete.
- Avoid contact with the skin.
- Wash away cement and concrete with water when in contact with skin
- Protect skin that is exposed.

  EXAMPLES: Protective skin cream, body lotion, or mild ointments

- Wear protective clothing.

  EXAMPLES: Close-fitting clothing with snug wristbands, ankle bands, and neckband

- Wear properly maintained, OSHA-approved safety equipment.

  EXAMPLES: Respirator, goggles, face shield, hard hat, safety belt, safety harness

- Ensure adequate ventilation is provided when using epoxy resins, organic solvents, and other toxic substances.
- **Never** use solvents to clean skin.
- Immediately remove epoxy, organic solvents, and other toxic substances from skin; use appropriate cleansing agents to remove these substances.

Safety precautions pertaining to scaffolds.

- Observe OSHA regulations.
- Use only approved scaffolding.
- Inspect scaffolds regularly.
- Install all braces and accessories according to manufacturer's recommendations.
- Install anchors and guy wires on freestanding scaffolds as required.
- Keep scaffolds plumb and level.
- **Do not** overload scaffolds.
- Be sure all safety rails are installed according to OSHA regulations.
- Be sure wheels are locked before using rolling scaffolds.
- Always check for electrical wires and disengage wires before erecting metal scaffolds in the vicinity.
- **Do not** work on scaffolds during storms or high winds, or when scaffolds are covered with ice or snow.

Safety precautions pertaining to ladders

- Fully spread and lock stepladders before using.
- **Do not** use ladders that are **not** equipped with safety shoes.
- **Never** overreach from a ladder.
- **Never** work from the top step of a ladder.
- **Never** use a ladder in a horizontal position.
- **Do not** climb a ladder that is occupied by someone else.

- **Do not** carry loads up/down a ladder. Use a rope to raise/lower loads.

- **Never** use a metal ladder when there is any possibility of contact with electrical wires or conductors.

- Place ladders with approximately one-quarter of their support length away from vertical plane of top support, and extend ladders at least 3 feet above top support (Figures 1 and 2).

FIGURE 1

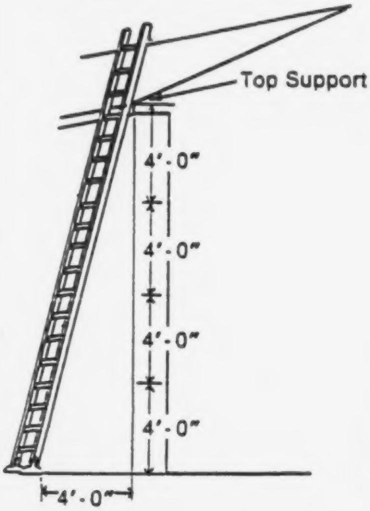
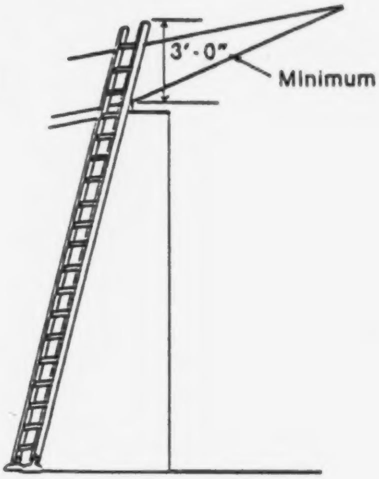


FIGURE 2



- Secure ladders at both top and bottom to prevent displacement; brace long ladders at intermediate points to prevent spring.

- Remove ladder when you are finished using it, and always remove and store ladder at end of workday.

Safety precautions pertaining to excavations

NOTE: There are three safety points to remember on all excavations; protection of worker, protection of public, and protection of nearby structures and utilities.

- Check nearby structures, such as trees and rocks, to see how they will affect the excavation.

- Check with local utility companies (prior to digging) to find out if there are any underground utilities.

  NOTE: This is a one-call system (usually an 800 number) which will notify all companies with underground utilities in the area.

- Keep a close check on excavation procedures to assure there are no hazards or neglect of safety precautions.

- Be sure all personnel involved in the excavation procedures are properly dressed and are using prescribed safety gear and equipment.

- Make sure shoring, sloping of the ground, or some other equivalent means is provided in all excavations.

- Make sure heavy equipment and materials are kept back from the excavation as far as possible.

- Shore, brace, or drive piling if vibrations or blasting are occurring near excavation.

- Inspect shoring systems daily and after rainstorms or any change in conditions that may increase the possibility of cave-ins or slides.

- Be sure steps or ladders are provided every 25 feet when depth of excavation is 4 feet or more.

- Stop all work if dangerous ground movements are apparent, such as settlement or tension cracks.

- Install barricades, guardrails, or fences completely around perimeter of an excavation.

- Backfill excavations as soon as possible.

OBJECTIVE 5

Given a color code, match colors to their correct safety application.

Federal safety red

- Designates danger
- Identifies fire-protection equipment and its location
- Identifies portable containers of flammable liquids
- Identifies emergency stop bars, stop buttons, and emergency electrical stop switches on machinery

Federal safety yellow

- Designates caution and marks physical hazards

  EXAMPLES: Low beams, protruding extensions, steps

- Designates waste containers for explosive or combustible materials
- Designates caution against starting, using, or moving equipment while it is under repair, and against the use of defective equipment
- Identifies the starting point or power source of machinery

Federal safety orange

- Designates dangerous parts of equipment that may cut, crush, shock, or otherwise injure
- Designates safety starter buttons and parts of equipment that may cause electrical shock
- Designates exposed parts (edges only) of pulleys, gears, rollers, cutting devices, and power saws

Federal safety purple (or black or magenta on safety yellow)

- Designates radiation hazards

Federal safety blue

- Designates caution against and provides information about machines or equipment out of order or under repair
- Identifies out-of-order signs on equipment

Federal safety green

- Designates location of safety equipment other than fire-fighting equipment
- Designates location of first-aid equipment

Federal safety black and white (used individually or in combination)

- Designates traffic flow
- Designates items for housekeeping purposes
- Designates storage areas

OBJECTIVE 6 **Provided a list of terms associated with toxic substances, select their correct definitions and exposure consequences.**

- **toxic** — a substance or material having the nature of a poison
- **absorb** — to suck up or take up (as a sponge)
- **solvent** — liquid that dissolves or is capable of dissolving one or more other substances
- **vapor** — diffused matter suspended in the air in a gaseous state as distinguished from the liquid or solid state
- **irritate** — to cause itching, burning, and/or reddening
- **contaminate** — to make impure or unclean; to bring into contact with dirt or other impurity from an outside source

- **fume** — smoke, vapor, or gas; the suspension of microscopic particles in gas; engine exhaust

- **mist** — moisture in the form of particles floating or falling in the air

Forms of toxic substances

- Solids

- EXAMPLES: Asbestos, cement

- Liquids

  EXAMPLES: Acetone, chlorine, epoxies

- Vapors, mists, fumes, and gases

- EXAMPLES: Carbon monoxide, ozone, methane

Ways toxic substances enter the body

- Inhaled

  EXAMPLES: Toxic substances such as carbon monoxide, airborne pesticides, and dusts may be inhaled directly from the air when you are breathing. Smokers may also inhale gases, dust, fumes, and mists when smoking or when smoking cigarettes, pipes, or cigars contaminated by direct contact with toxic substances.

- Absorbed through the skin

  EXAMPLES: Some lead compounds, pesticides, and solvents can be absorbed directly through the skin.

- Ingested while eating and drinking

  EXAMPLES: Food and drink may be contaminated from contact with toxic substances on the hands or from dust, fumes, and mists that settle on them from the air.

- Contracted through open cuts and sores

  EXAMPLES: Open cuts and sores come in direct contact with toxic substances when they are touched by contaminated hands or when dust, fumes, and mists settle on them from the air.

Ways toxic substances affect the body

NOTE: Some toxic substances have both local and systemic effects. Toluene solvent, for example, causes a local irritation to the eyes and respiratory tract, but it can also spread to affect the nervous system and the liver.

- Local effect — Substance comes in direct contact with an area of the body and affects only that area

  EXAMPLE: An irritating gas causes burning of the eyes, nose, throat, and lungs when it is inhaled.

- Systemic effect — Substance is absorbed by one area of the body but spreads throughout the body and may affect other body systems

  EXAMPLE: When inhaled, a solvent vapor eventually causes a headache and a drunken feeling.

Consequences of exposure to toxic substances

CAUTION: Exposure to toxic substances, such as certain solvents, could cause consequences from mild irritation to death. Damage severity depends on the toxin and the degree of exposure.

- Mild irritation

  EXAMPLES: Skin rashes, headache, burning eyes, sneezing, coughing

- Severe damage to any or all of the body's systems

  EXAMPLES: Shortness of breath, genetic abnormalities, coma, shock, hemorrhage, allergies

- Terminal conditions or diseases

  EXAMPLES: Cancer, black lung, suffocation, emphysema

OBJECTIVE 7

Given alternatives, select the correct reasons for the use of Material Safety Data Sheets (MSDS).

MSDS were developed to provide both the employer and employee with information necessary for working safely with hazardous chemicals.

1. Provide information on health hazards
   - Hazard rating
   - Type of hazard
   - Symptoms of exposure
   - Effects of exposure
2. Provide steps for emergency first aid
3. Provide fire, explosion, and reactivity data
   - Extinguishing agents and fire fighting methods
   - Products formed by fire or excessive heat
   - Conditions to avoid
   - Stability
   - Incompatible materials and reactions
   - Products of decomposition
   - Hazardous polymerization

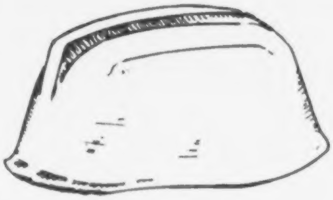
4. Provide information on types of protective equipment
   - Personal protection
   - Ventilation
   - Additional protective equipment
5. Provide information on handling and storage
   - Handling and storage methods
   - Leakage and spill control
   - Waste disposal
6. Provide instructions for medical management
   - General instructions
   - Personal hygiene
   - Medical records
   - Exposure limits
7. Provide physical and chemical properties data
   - Physical state
   - Color
   - Chemical formula
   - Specific chemical composition
8. Provide other additional information

OBJECTIVE 8 **Given a picture, identify personal safety equipment and their purpose.**

- Hard hat

  Head protection is required on all jobs and is used to protect individuals from possible head injury.

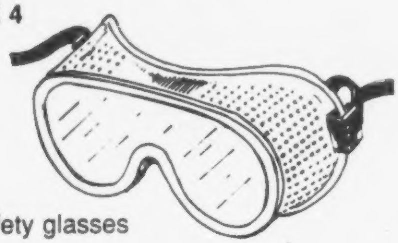
FIGURE 3



- Goggles

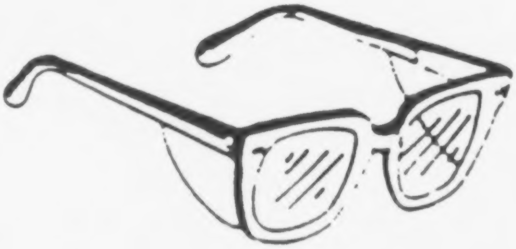
  Eye protection is provided whenever there is a possibility of eye injury.

FIGURE 4



- Safety glasses

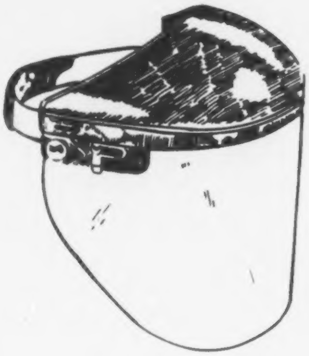
FIGURE 5



- Face shield

  Face shield should be used whenever there is a potential danger of face injury.

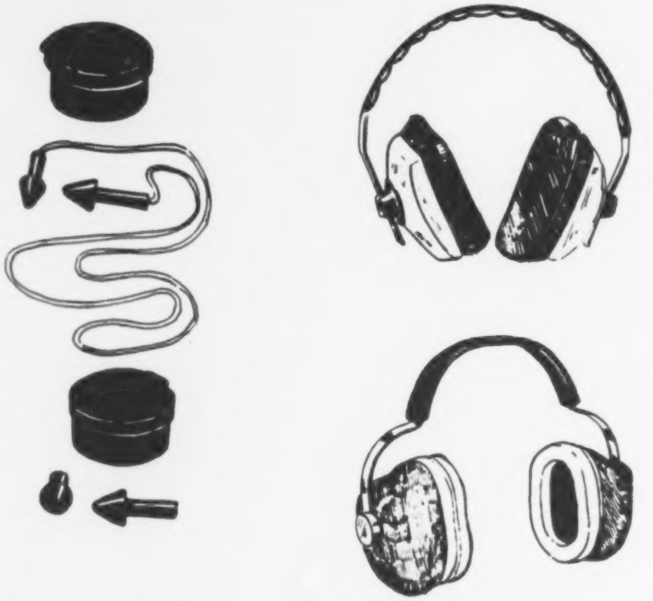
FIGURE 6



- Ear protectors

  Ear protective devices should be provided and used when working near extreme or prolonged noise levels.

FIGURE 7

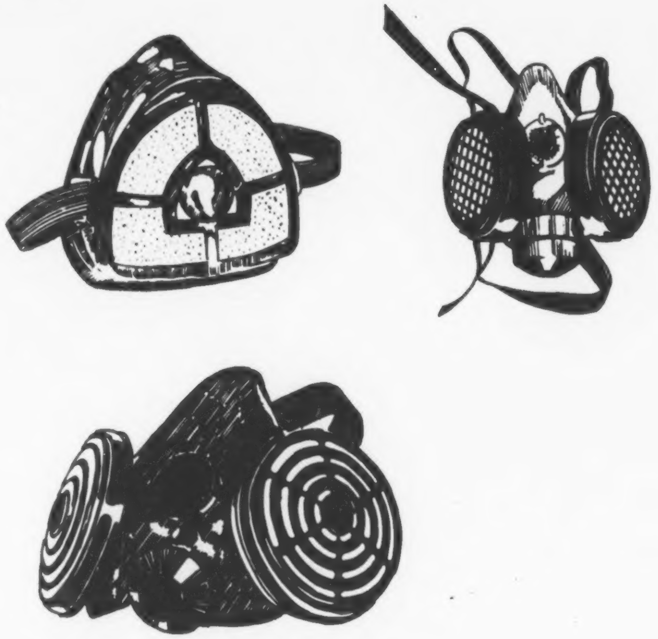


- Respirators

  Clean, appropriate respirators for the use should be worn.

  NOTE: Facial hair may interfere with their proper operation.

FIGURE 8



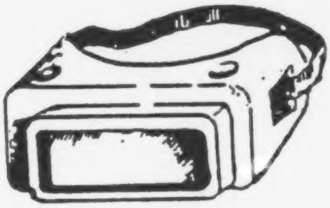
- Supply air system

  A system of air pumps, ducts, and outlets designed to provide air to confined spaces

- Welding goggles

  Welding goggles or hoods should be worn when welding or cutting to protect the eyes.

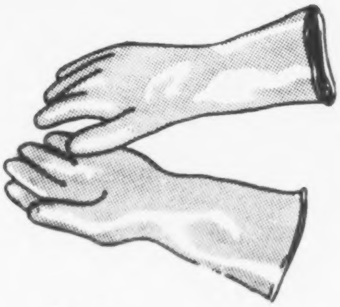
FIGURE 9



- Rubber gloves or leather gloves

  Rubber gloves should be worn when working with concrete, epoxies and other hazardous materials.

FIGURE 10



- Boots

  Steel toed/shanked heel, rubber boots, and slip-on toe protection

- Fall protection equipment

  Fall protection equipment is necessary when working on elevated structures such as scaffolds, highrise buildings, and roofs.

FIGURE 11

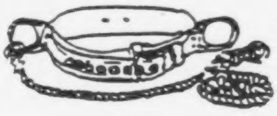


FIGURE 12

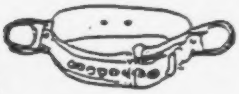
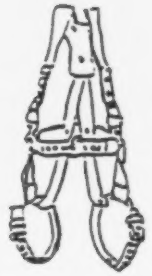


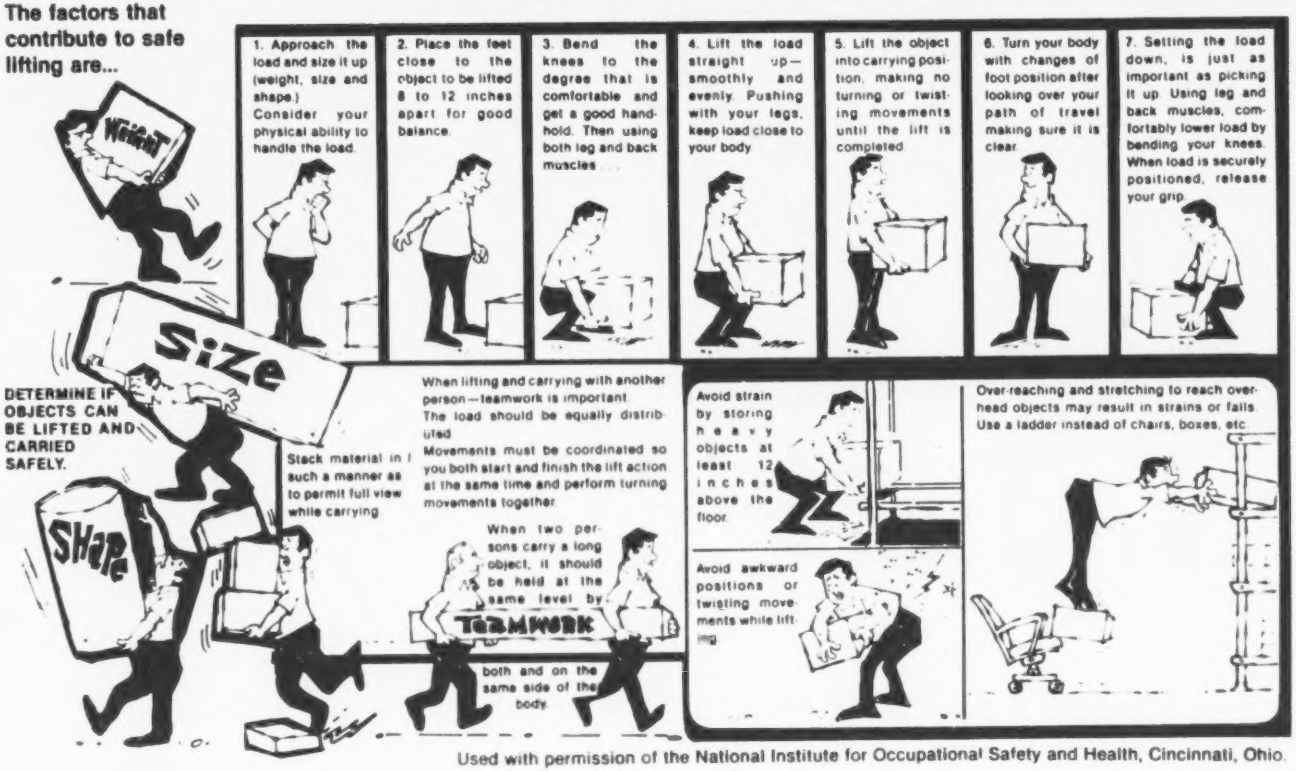
FIGURE 13



- Back support brace
- Caps on protruding rebar

HOW TO LIFT SAFELY

The following safe practices should be observed in order to avoid injury.



The factors that contribute to safe lifting are...

DETERMINE IF OBJECTS CAN BE LIFTED AND CARRIED SAFELY.

1. Approach the load and size it up (weight, size and shape.) Consider your physical ability to handle the load.

2. Place the feet close to the object to be lifted 8 to 12 inches apart for good balance.

3. Bend the knees to the degree that is comfortable and get a good handhold. Then using both leg and back muscles . . .

4. Lift the load straight up—smoothly and evenly. Pushing with your legs, keep load close to your body.

5. Lift the object into carrying position, making no turning or twisting movements until the lift is completed.

6. Turn your body with changes of foot position after looking over your path of travel making sure it is clear.

7. Setting the load down, is just as important as picking it up. Using leg and back muscles, comfortably lower load by bending your knees. When load is securely positioned, release your grip.

Stack material in such a manner as to permit full view while carrying.

When lifting and carrying with another person—teamwork is important. The load should be equally distributed. Movements must be coordinated so you both start and finish the lift action at the same time and perform turning movements together.

When two persons carry a long object, it should be held at the same level by both and on the same side of the body.

Avoid strain by storing heavy objects at least 12 inches above the floor.

Avoid awkward positions or twisting movements while lifting.

Over-reaching and stretching to reach overhead objects may result in strains or falls. Use a ladder instead of chairs, boxes, etc.

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MATERIAL SAFETY DATA SHEET	SUBSTANCE - (Chemical Name) Acetylene (Ethine, Ethyne)	NO. BG-2

PRODUCT NAME, NUMBER, SYNONYM CAS #74-86-2	COMMON OR TRADE NAME Acetylene
MANUFACTURER'S NAME AND ADDRESS	TELEPHONE NUMBER - -

HEALTH HAZARDS

HAZARD RATING (X) DANGER ( ) WARNING ( ) CAUTION

TYPE OF HAZARD Asphyxiant Gas, Flammable, Explosion

SYMPTOMS OF EXPOSURE
Headache, breathlessness, weakness, dizziness, loss of consciousness

EFFECTS OF EXPOSURE At concentration of 20% or more acetylene-headache, breathlessness, weakness. At concentration of 40% or more acetylene-collapse, loss of consciousness, fatality.

EMERGENCY FIRST AID

Remove exposed person at once to uncontaminated area, keep warm and quiet, administer oxygen if loss of consciousness has occurred, begin artificial respiration if breathing has stopped, call a physician at once.

FIRE, EXPLOSION, AND REACTIVITY DATA

EXTINGUISHING AGENTS AND FIRE FIGHTING METHODS Use Class C or Class ABC Carbon Dioxide, dry chemical, or multi-purpose dry chemical extinguisher. Use water in spray form to keep exposed facilities cool. Attempt to stop *

FLASH POINT		FLAMMABLE OR EXPLOSIVE LIMIT	
OPEN CUP °C	CLOSED CUP 17.8 °C	LOWER 2.5 %	UPPER 82 %
IGNITION TEMPERATURE °C		AUTO-IGNITION TEMPERATURE 300 °C	

PRODUCTS FORMED BY FIRE OR EXCESSIVE HEAT
Hydrogen, carbon

CONDITIONS TO AVOID Avoid excessive build up of acetylene which may lead to flash fire or explosion. Avoid heat and open flames. Remove sources of accidental ignition.

STABILITY ( ) Stable (X) Unstable—Explain Conditions Do not use, generate or distribute through hose or pipe, acetylene at pressures in excess-15 psig.

INCOMPATIBLE MATERIALS AND REACTIONS Forms spontaneously explosive compounds with copper, silver, and mercury. Will react explosively with chlorine, **

PRODUCTS OF DECOMPOSITION
Hydrogen, carbon

HAZARDOUS POLYMERIZATION (X) Will not occur ( ) May occur—Explain Reaction and Products

PROTECTION EQUIPMENT

PERSONAL PROTECTION Respiratory protection-self-contained breathing apparatus and positive pressure hose mask, or air-line mask. Protective clothing—leather gloves for cylinder handling.

VENTILATION Local exhaust—sufficient to maintain concentration below 2.5% lower explosive limit.

ADDITIONAL PROTECTIVE EQUIPMENT For welding operations involving acetylene—use appropriate protective equipment.

HANDLING AND STORAGE

BG-2

HANDLING AND STORAGE METHODS Keep valves closed, protective caps in place, check fusible plugs for leaks. Use in vertical position only. Store cylinders in vertical position, away from oxygen supplies and from sources of heat and ignition. Follow OSHA regulations.

LEAKAGE AND SPILL CONTROL Liquid acetone may leak from cylinder stored horizontally.

WASTE DISPOSAL Remove cylinder and allow acetylene to escape slowly. If disposal into a pit, burn with care.

MEDICAL MANAGEMENT

GENERAL INSTRUCTIONS "Treatment of those exposed to acetylene is symptomatic and no specific antidotes are known. Nausea, vomiting, and mental ***

PERSONAL HYGIENE Warn employees of the asphyxiant nature of acetylene.

MEDICAL RECORDS

PRE-PLACEMENT No known sensitivity. PERIODIC Not indicated.

EXPOSURE LIMITS

THRESHOLD LIMIT VALUE

CEILING CONCENTRATION

ODOR THRESHOLD

OTHER

PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE Gas at normal temperatures and pressures

COLOR Colorless

ODOR Distinctive, like garlic when generated from carbide.

CHEMICAL FORMULA C_2H_2 $H-C\equiv C-H$

CHEMICAL COMPOSITION (BE SPECIFIC) **

COMPOUND	PERCENT	TLV	COMPOUND	PERCENT	TLV

BOILING POINT −75 °C

MELTING POINT −82 °C

VAPOR PRESSURE

VAPOR DENSITY 1.17g/L at 0°C

PERCENTAGE VOLATILE

EVAPORATION RATE

SPECIFIC GRAVITY 0.9073

pH CONCENTRATION

SOLUBILITY Soluble in organic liquids (acetone, benzene, alcohol) and slightly soluble in water.

CORROSIVENESS

ADDITIONAL COMMENTS

ATTACH THE FOLLOWING:
SAFETY INFORMATION FROM PRODUCT LABEL—ATTACH LABEL OR QUOTE
PRODUCT INFORMATION DATA SHEETS
OTHER MATERIALS

See also: Manufacturing Chemists Association Chemical Safety Data Sheet SD-7

* the supply of acetylene or let acetylene be consumed by burning.

** fluorine, bromine on exposure to sunlight.

*** confusion may be present for short periods after recovery."

FORM COMPLETION DATE

FORM REVISION DATE

The information herein is given in good faith but no warranty, express or implied, is made.

SAMPLE SAFETY FORMS

Subcommittee: ______________________

Instructor: _________________________

Re: Code of Safe Practices

This will acknowledge my receipt of

1. A printed copy of the "Code of Safe Practices" and
2. A printed copy of the "Code of Safe Practices and Operations

In consideration of my acceptance into the Apprenticeship and Training Program, I acknowledge that I have read the foregoing documents and know and understand the contents thereof and, further, and I have had an opportunity to discuss same with my instructor prior to the execution of this document.

Signed at ___________________, __________
(CITY) (STATE)

this ______________ of __________, 198__.
(DAY) (MONTH)

____
(SIGNATURE)

____
(NAME — Please print)

"Safety Agreement," "Code of Safe Practices," and "Code of Safe Practices and Operations" adapted with permission of the Northern California Joint Apprenticeship and Training Committee, Pleasanton, California.

CODE OF SAFE PRACTICES

Accident prevention — All persons must abide by OSHA safety standards, general industry safety orders, and company rules. Posters and other safety materials are displayed for the benefit of the employee; read and abide by these suggestions. Give every possible aid in the event of injury.

Job site — Keep work areas free of debris. Good housekeeping is essential. Remove or correct any hazards. Never work or pass under suspended load or equipment.

Work habits — Assist other trades when necessary to maintain safe operations. Never place yourself in a dangerous position or allow others to work in a dangerous position. Use the right tool or equipment for all work. Never use any alcoholic beverage or illegal drugs on the job. Do not be a party to horseplay; pranks can be fatal. Construction sites offer unusual hazards; walk and work with all due respect for those hazards.

Hand tools — Always use the proper tools and maintain them in good condition. Never use tools with loose or broken handles, mushroom heads, or dull blades. Always use the correct size or type of tool for the job.

Power tools — Never use a powder-activated tool unless you have been licensed. Know the proper method of using a circular saw; never block back the retractable guard; it is for your protection. Never use a tool with which you are not fully experienced.

Materials-handling — Lift with the leg muscles; do not bend over and lift with your back. Learn and practice the proper way to lift or carry material or any object. Do not operate any type of powered materials-handling or hoisting equipment unless authorized. Get help in handling heavy or bulky loads.

Protective devices — Handrails, guardrails, protective covers, toeboards, ramps, and safety devices installed on various tools are there for your safety; do not tamper with, remove, or damage these protective devices. Replace, correct, or report any unsafe guard or device.

Electrical — Respect electricity under all circumstances. Never use electrical equipment in areas or excessive moisture unless you have taken all safeguards. Approved electric power tools and extensions are grounded; never alter cords or plugs.

Confined space — Never enter any vault, manhole, silo, or any enclosed area until you are certain that the air within contains no flammable, contaminated, or toxic vapor or gas. Thoroughly test, ventilate, and wear adequate protective gear before entering enclosed areas.

Transportation — When transportation is necessary in other than a passenger vehicle, ride or sit in the cab; do not stand on the bed of a truck; never ride with arms or legs over the sides. Do not sit on the tailgate; it must be closed during transportation of passengers. Be careful of any tools, materials, or equipment within the truck body that may shift or slide and cause injury.

Flammables, solvents — Never use gasoline or other highly volatile liquids for cleaning purposes. Oxygen and acetylene cylinders can be dangerous; secure them against rolling or tipping. Handle carefully any tanks or containers that contain explosive vapor or liquid, and never expose these containers to open flame or spark.

Personal protection — Stay clear of heavy earth-moving equipment. Remain aware of warning devices such as bells, horns, or whistles. Hard hats are mandatory; always wear one on any construction job. Use other protective gear as recommended when exposed to unusual hazards. Never attempt an operation with which you are not familiar; ask first for specific instructions. Wear suitable work clothes at all times. Wear heavy-soled shoes; they protect you against a puncture injury.

First aid — Basic first aid is of value in the event of injury. Know how to give first aid; it may save a fellow worker from death. Unless you completely understand the proper method, you should not move a person who is seriously injured

Safety meetings — Tool box meetings are held for a purpose. Attend willingly and participate by offering ideas to develop accident-free job sites. Accept advice offered by others who may be more experienced.

Accident reporting — Immediately report all personal injuries.

CODE OF SAFE PRACTICES AND OPERATIONS

GENERAL SAFETY

- Be alert for unsafe work methods or unsafe conditions, and correct them or report them to your supervisor immediately.
- Immediately report every injury—whether serious or not—to your supervisor.
- Do not drink alcohol or take narcotics or habit-forming drugs in any form just before or during work hours.
- Do not participate in horseplay, practical jokes, or sparring; they cause accidents.
- A good night's sleep and good food make you feel better and help you avoid accidents. Get your share of sleep and good food.

DO'S AND DON'TS

- Do's
  - — Do bend all exposed nails and staples.
  - — Do keep work area clean and free of debris, and secure all air, water, and electric lines so that they do not become tripping hazards.
  - — Do use safety belts where necessary, and be sure safety belts are tied off at an area free of the work platform.
  - — Do wash your hands before eating or drinking.
  - — Do make sure all accidents and injuries are reported immediately to your supervisor.
  - — Do remember that you can be taken off the job for violating safety rules, for working under unsafe conditions, or for causing an unsafe condition.
  - — Do report any unsafe condition to your supervisor.
  - — When working in an excavation, do be alert for sliding soil and falling rocks, and be certain that trenching and excavating are properly shored.

  - *At all times*, do be alert for any equipment moving near you.
  - Do *be doubly alert* and thoroughly examine all shoring after a rainfall.
  - Safety meetings are for your protection and education; do be sure you attend and pay attention.
- Do not's
  - Do not work without a hard hat.
  - Do not work without proper eye protection.
  - Do not work without an approved protective respirator.
  - Do not work without proper footwear.
  - Do not work without proper protective clothing.
  - Do not use electrical equipment in a wet or damp area.
  - Do not leave electrical wires or equipment in water.
  - Do not use metal extension around electrical equipment or power lines.
  - Do not use metal extension handles; they are illegal. This applies to metal extensions affixed to bull floats or fresnos.
  - Do not overreach when working from a ladder.
  - Do not use contaminated water cans.
  - Do not enter an unsafe work area. Report any unsafe area to your supervisor.
  - Do not bypass any safeguards.
  - Do not work in a confined area where gasoline-driven equipment is running unless proper ventilation is supplied.

SLIPS AND FALLS

NOTE: More people are injured in slips and falls than in any other type of accident. Follow these safe practices to prevent slips and falls.

- Wear safe, strong shoes that are in good repair.
- Watch where you step. Be sure your footing is secure.
- Do not allow yourself to get in an awkward position. Stay in control of your movements at all times.
- Maintain clean, smooth walking and working surfaces. Fill holes, ruts, and cracks; clean up slippery material.
- Pick up litter. Do not allow tripping hazards to exist.
- Install cables, extension cords, and hoses so that they will not become tripping hazards.
- If you must climb to reach something, use a sound ladder that has been safely set in position and properly secured at both top and bottom. Use only Type I industrial ladders. Don't carry material up a ladder.
- When climbing a ladder, always face the ladder and use both hands.
- When reaching from a ladder, keep your shoulder inside the vertical stringer. Do not overreach; move the ladder.
- Walk, don't run.
- Construct and use only safe scaffolds. If a scaffold is wobbly or bouncy, or can be pulled down easily, it is not safe. A scaffold should have a sound structure and have toeboards and handrails. A scaffold's wooden floor planks must be free of knots, and broken members must be repaired immediately.
- Scaffolding must have component parts consisting of toprails that are 42 inches above platform, a midrail, and a toeboard that is a minimum of 4 inches high and located no higher than ¼ inch above the platform. Platforms must be planked solid. Your supervisor will give you further specifications for properly erecting and using scaffolding.

MATERIALS-HANDLING

NOTE: Every construction worker handles materials. It is easier and faster to handle materials the safe way. The following practices will help you move materials safely.

- Do not move an object twice if once will do. Plan your work.
- Do not try to lift objects that may be beyond your physical capacity and training. Get help, or use a machine or hand truck.
- Use gloves, aprons, or pads when handling materials that are rough, sharp, hot or cold, or covered with hazardous substances.
- While moving a load, be sure you can see where you are going.
- When carrying long objects such as pipe or lumber, keep the leading end of the object above your head height and the trailing end close to the ground.
- When lifting heavy objects from the floor, kneel on one knee, roll or tip the object onto the other knee, then pull the load next to your stomach and using your legs with your back straight, stand up. Use the reverse procedure to put down a load. Remember: Your back is not made of steel.
- Pile material on a strong, level base. Interlock material so the pile will not come apart. Chock around stock so it cannot roll.

HAND TOOLS

NOTE: Good workers can be recognized by the tools they keep.

- Dress cutting tools at the proper angle and keep them sharp. Keep cutting tools in a scabbard—not in your pocket. Store cutting tools in a safe place.
- Dress the heads of most striking tools so they are square and without burrs.
- Use the right kind of tool. Use the right size tool. Remember: A screwdriver is not a punch or chisel, a file is not a pry bar, a wrench is not a hammer.

- Hold screwdrivers, wrenches, chisels, etc., in such a way that you will not be hurt if there is a slip or a miss.
- Do not use a file unless it has a handle.
- Remember: If you use the proper tool for the job, the job will not require as much muscle power.

PORTABLE POWER TOOLS

- Electrically ground every electric power tool before you use it. All circuits used to power tools must be GFI (Ground Fault Interruptable). This can be done at the AC breaker box or through special extension cords/circuits.
- Check the insulation on cords and the condition of plugs and sockets every day. If cords, plugs, or sockets are frayed, worn, cut, or broken, repair them before using.
- String temporary extension cords and power lines so they will not create a tripping hazard and so they are protected from physical damage.
- Do not use a circular saw unless the guard is in safe working condition.
- Before drilling through a wall, floor, or ceiling, be sure electric wires, gas lines, and high-pressure lines are not in the way.
- Do not use powder-actuated tools for driving nails or spikes in walls, ceilings, or floors when people are working on the other side.

POWER MACHINERY

NOTE: Remember: An unguarded hazardous piece of machinery will eventually injure someone.

- Use machinery only when you have been authorized to do so and when you have received safety instructions.
- Do not operate any machine unless its guards are in place.
- If you see an unguarded machine, report it at once.

- Be sure guards are safe. A *safe* guard covers all moving parts and is designed to permit safe oiling and adjustment.
- If you must remove a guard, stop the machine, lock the switch, and tag the machine so another worker cannot start it.
- Do not bypass two-handed controls or otherwise make them ineffective.
- Loose clothing is easily caught in machinery. Loose sleeves, ties, and aprons are taboo on the job. Wristwatches, rings, and other jewelry are also taboo.
- Use goggles, gloves, or any other protective equipment required by the job.

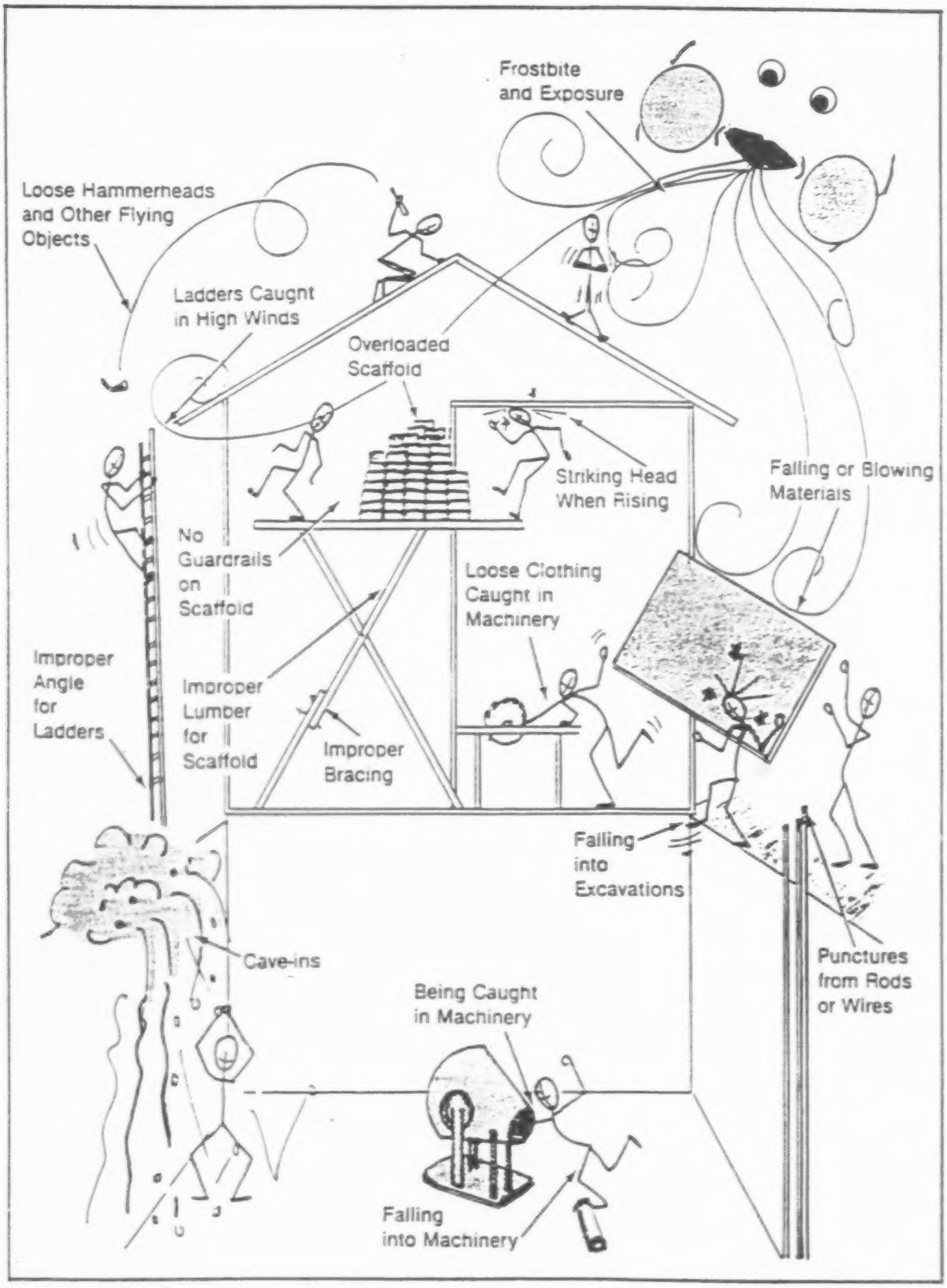
CHEMICALS

- Know the hazardous properties of the chemicals you work with.
- Read labels on containers and follow the manufacturer's instructions to the letter. Check MSDS requirements.
- Know the first-aid treatment for any chemical you work with, and be prepared to carry out that treatment immediately if need be.
- Store chemicals in a safe manner and according to the manufacturer's recommendations.
- Keep chemical containers closed when not in use.
- At regular intervals, inspect containers and pipelines that hold corrosive materials. Report leaks immediately.
- When using corrosive materials, know where the closest shower and eye fountain are located. Keep the shower and eye fountain unobstructed and in good working condition at all times.
- Use respirators, goggles, gloves, and protective equipment as required.

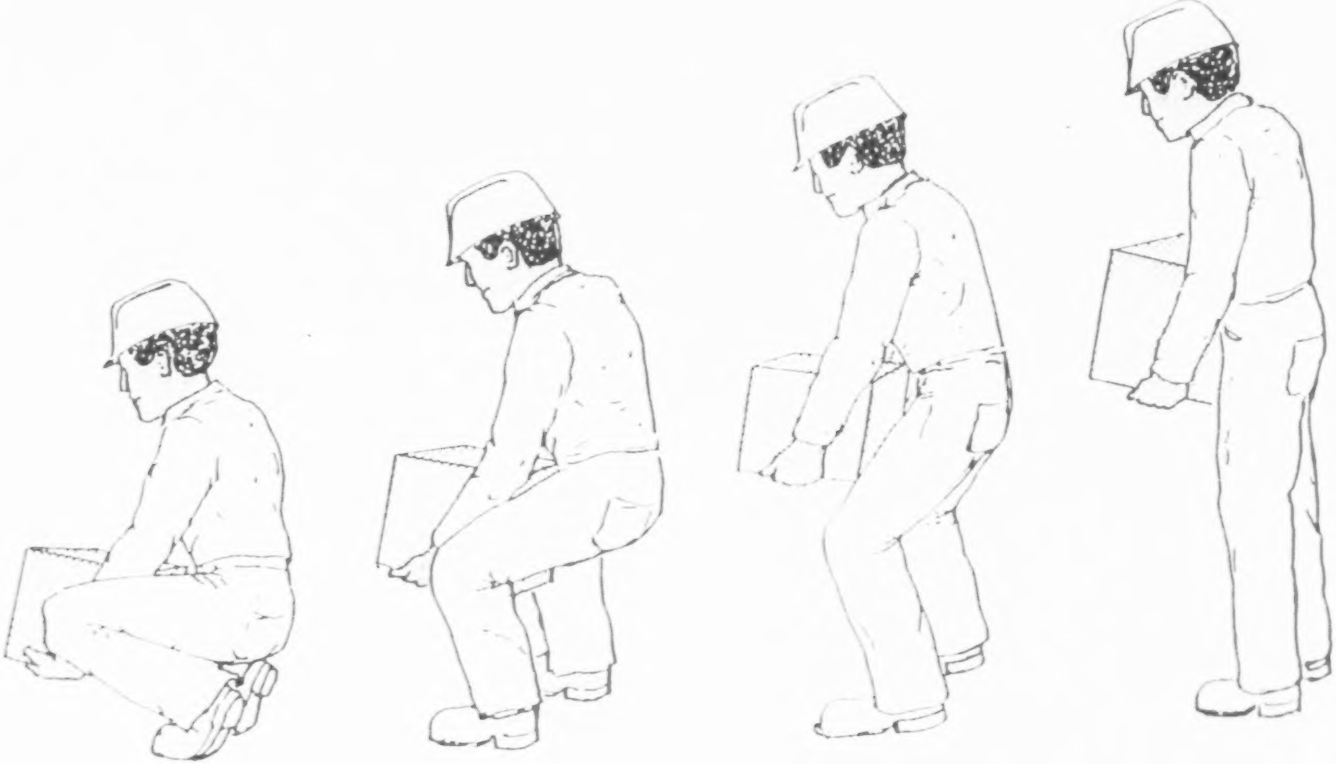
EQUIPMENT

- Use OSHA and the manufacturers safety procedures for:
  - Seat belts
  - Load capacity
  - Back-up alerts/alarms
  - Horns
  - Roll-over protection
  - Avoiding pinch-points
  - Required operator certifications

CONSTRUCTION RELATED HAZARDS


Frostbite and Exposure
Loose Hammerheads and Other Flying Objects
Ladders Caught in High Winds
Overloaded Scaffold
Striking Head When Rising
Falling or Blowing Materials
No Guardrails on Scaffold
Loose Clothing Caught in Machinery
Improper Angle for Ladders
Improper Lumber for Scaffold
Improper Bracing
Falling into Excavations
Cave-ins
Punctures from Rods or Wires
Being Caught in Machinery
Falling into Machinery

Correct Way to Lift Heavy Objects



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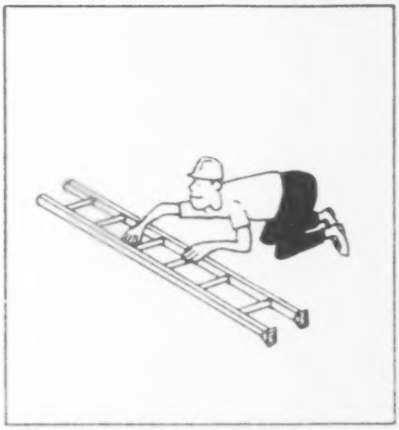
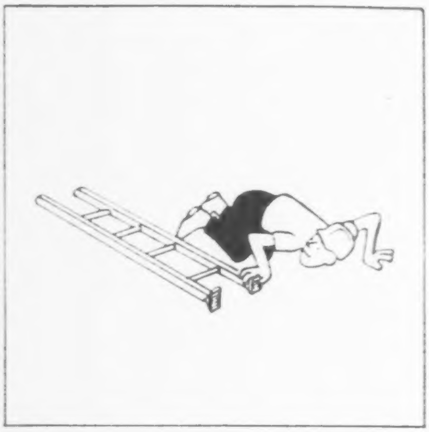
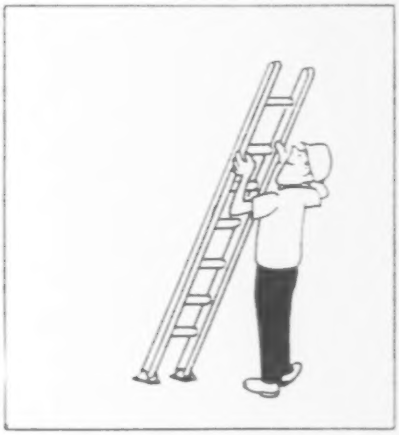
Ladder Safety



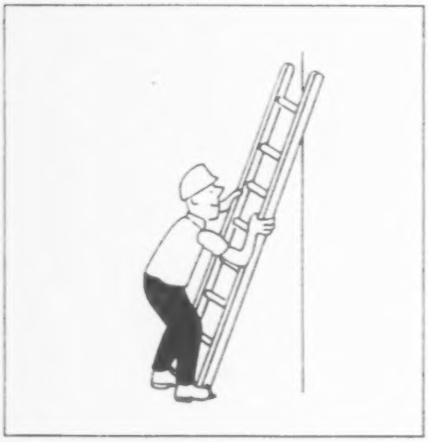
Check condition



Check safety shoes

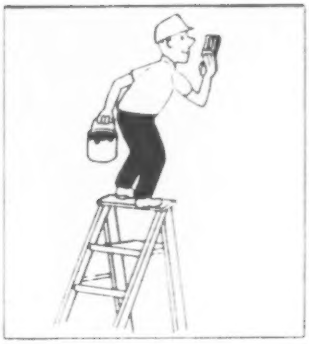


Check load limit

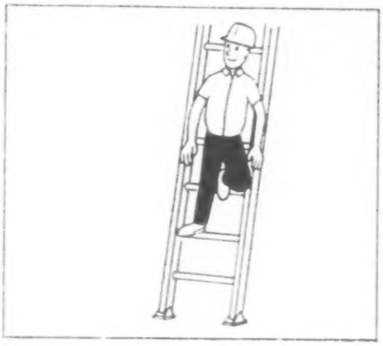


Place at appropriate angle

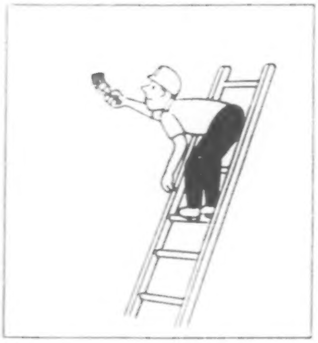
Ladder Danger



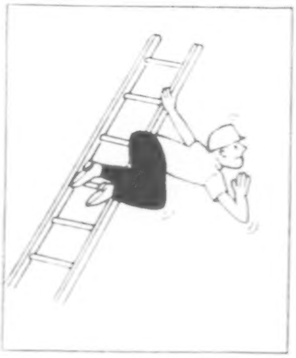
Standing on Top Rung



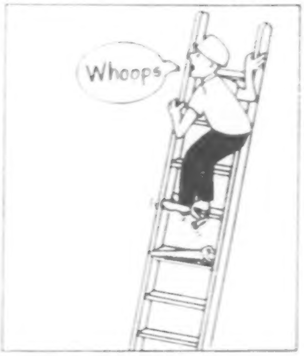
Facing Away from Ladder



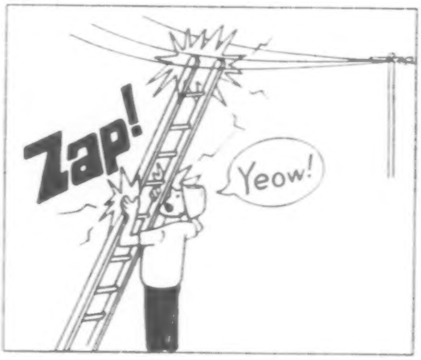
Reaching Too Far



Slipping From Slick, Oily Shoes



Slipping on Tools Left on Ladder

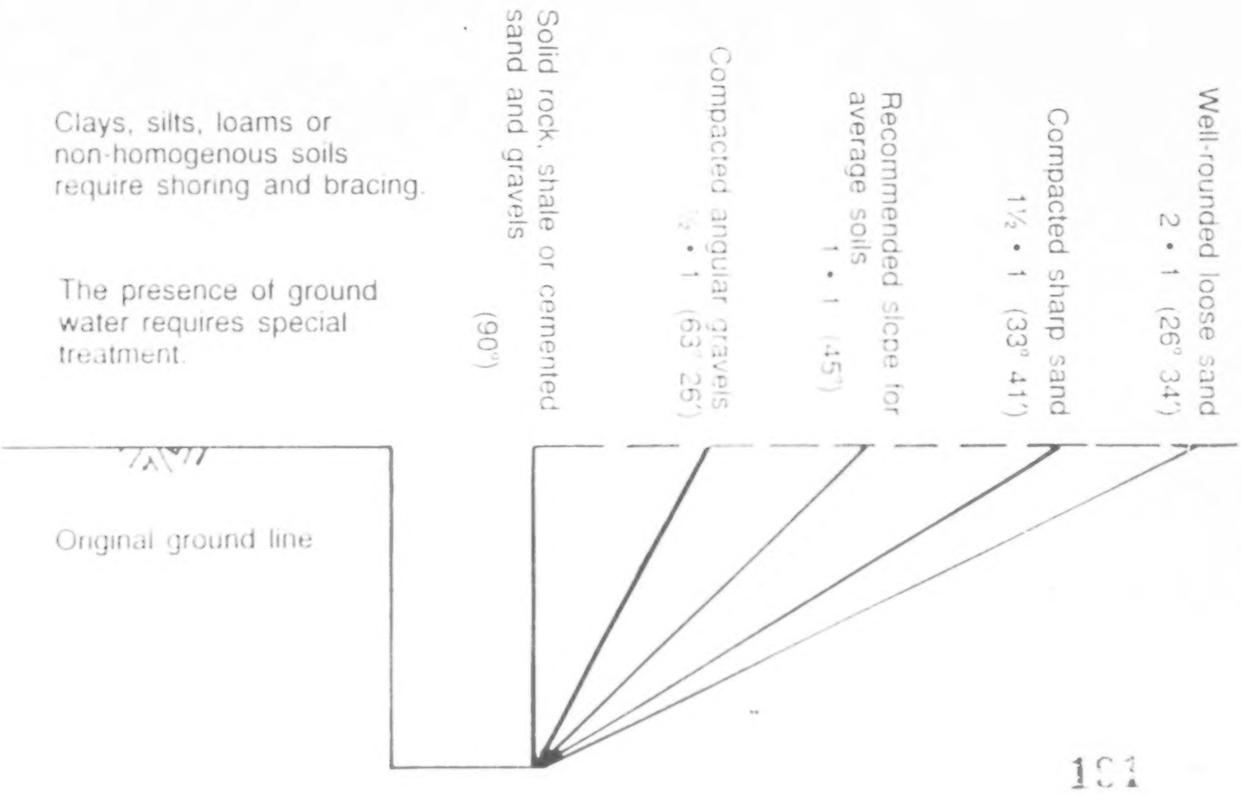


Contacting Electrical Lines with Metal Ladder

Approximate Angle of Repose For Sloping of Sides of Excavations

Clays, silts, loams or non-homogenous soils require shoring and bracing.

The presence of ground water requires special treatment.


Solid rock, shale or cemented sand and gravels
(90°)
Compacted angular gravels
½ • 1 (63° 26')
Recommended slope for average soils
1 • 1 (45°)
Compacted sharp sand
1½ • 1 (33° 41')
Well-rounded loose sand
2 • 1 (26° 34')
Original ground line

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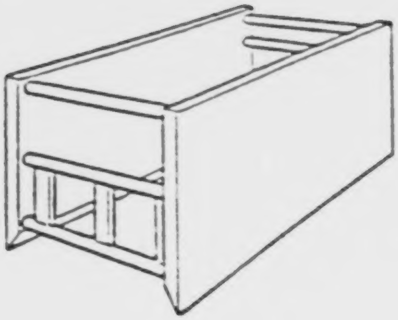
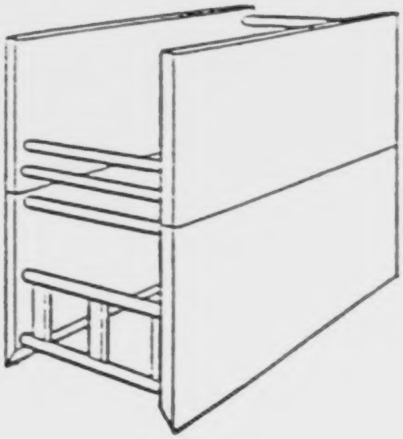
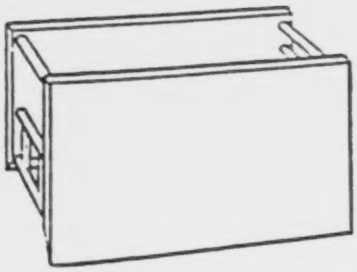
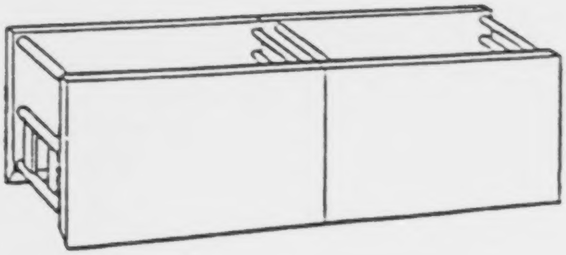
Trench Shield

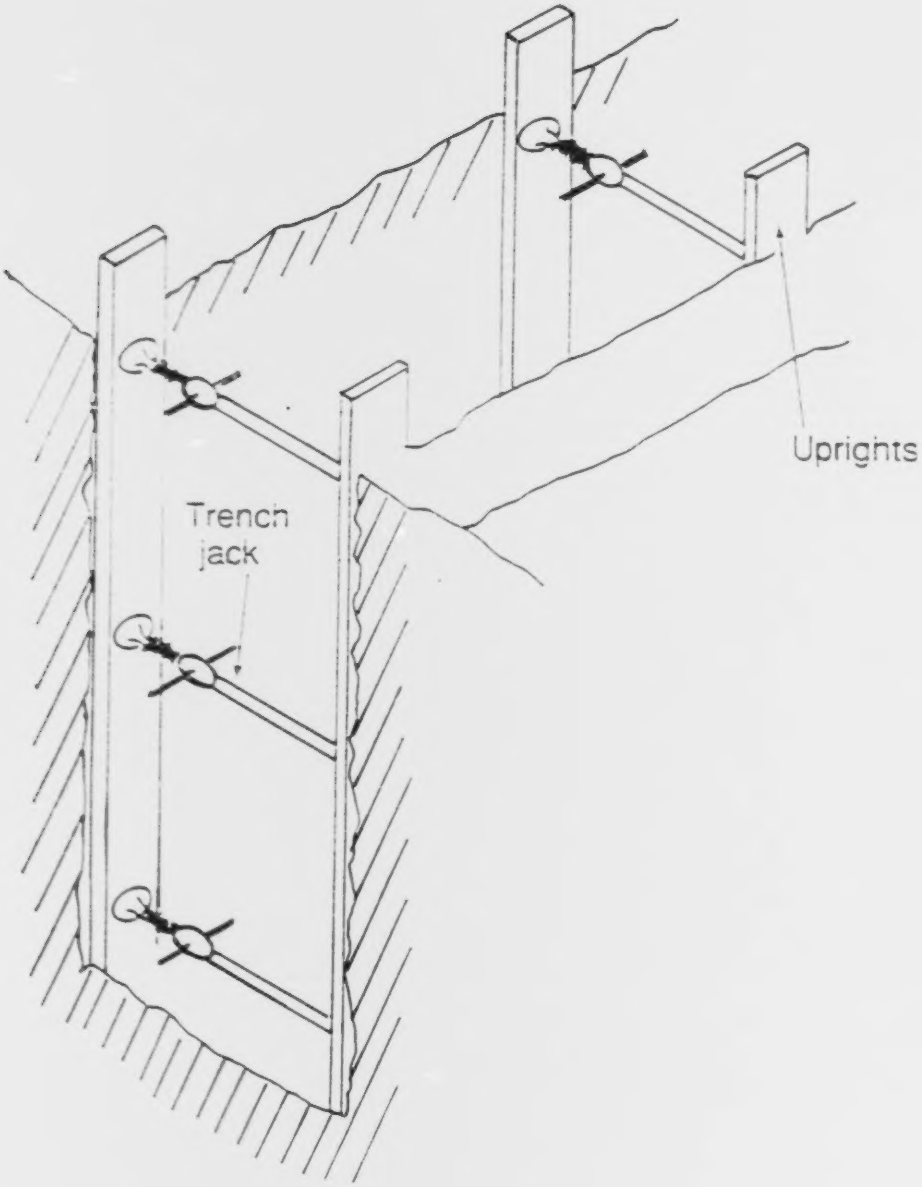




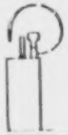
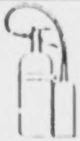
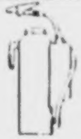
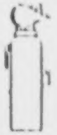
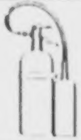
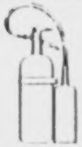
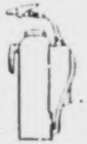
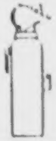
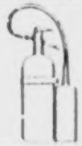
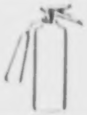




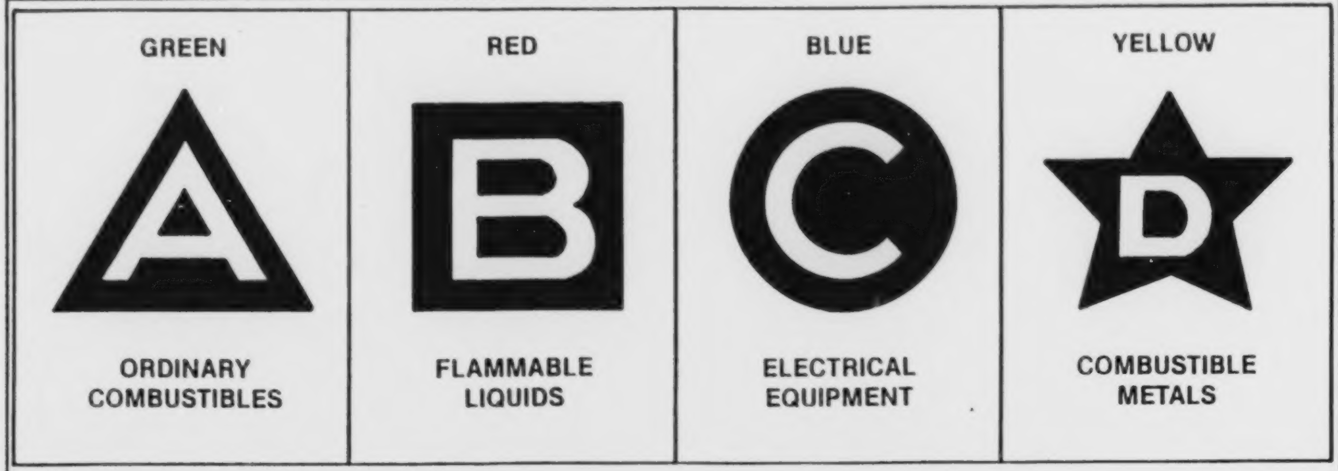
Types of Shoring


Trench jack
Uprights

Types of Fire Extinguishers

KIND OF FIRE		APPROVED TYPE OF EXTINGUISHER					
		MATCH UP PROPER EXTINGUISHER WITH CLASS OF FIRE SHOWN AT LEFT Important: Using the wrong type extinguisher for the fire may be dangerous					
DECIDE THE CLASS OF FIRE YOU ARE FIGHTING. . .	THEN CHECK THE COLUMNS TO THE RIGHT OF THAT CLASS	CARBON DIOXIDE Carbon Dioxide Gas Under Pressure	PUMP TANK Plain Water	MULTI-PURPOSE DRY CHEMICAL	ORDINARY DRY CHEMICAL	HALON	DRY POWDER
A **CLASS A FIRES** Use These Extinguishers ORDINARY COMBUSTIBLES ●Wood ●Paper ●Cloth, etc.							
B **CLASS B FIRES** Use These Extinguishers FLAMMABLE LIQUIDS, GREASE ●Gasoline ●Paints ●Oils, etc.							
C **CLASS C FIRES** Use These Extinguishers ELECTRICAL EQUIPMENT ●Motors ●Switches, etc.							
D **CLASS D FIRES** Use This Extinguisher COMBUSTIBLE METALS ●Iron ●Magnesium							

TRANSPARENCY MASTER 8- Fundamentals of Construction
CIMC - B 1 - 67
vo-tech

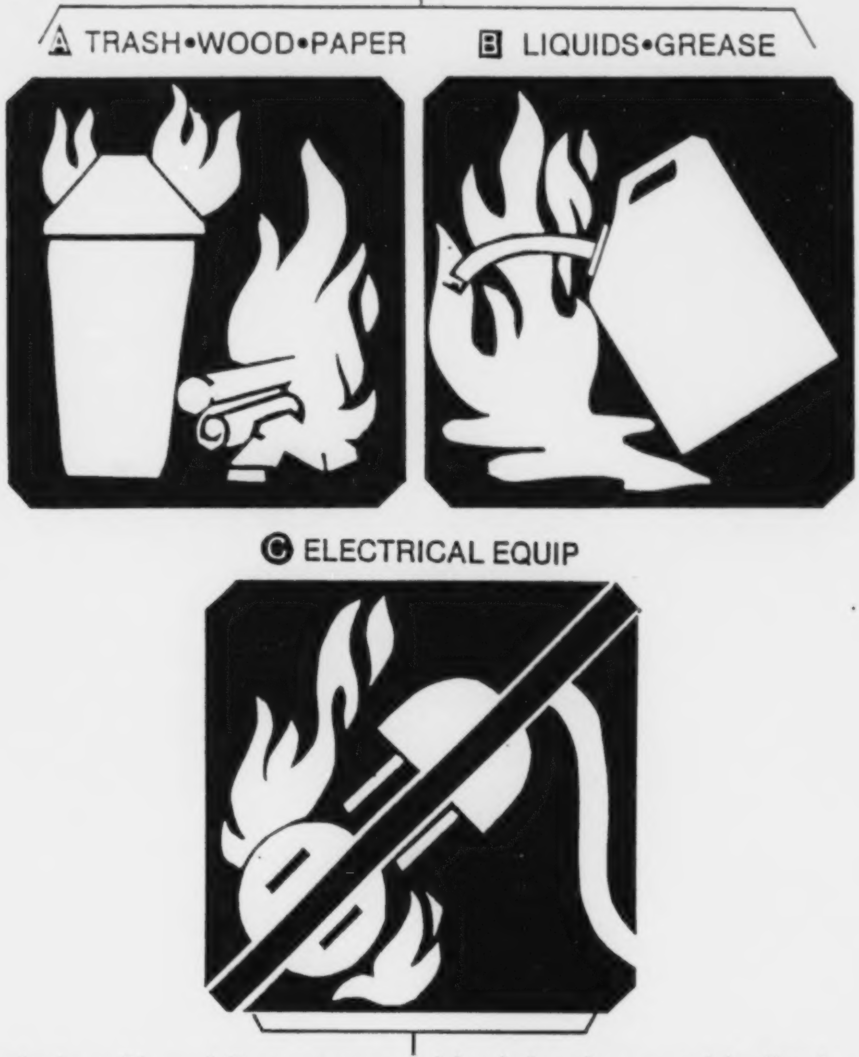

GREEN
A
ORDINARY COMBUSTIBLES
RED
B
FLAMMABLE LIQUIDS
BLUE
C
ELECTRICAL EQUIPMENT
YELLOW
D
COMBUSTIBLE METALS

Distinctive letters, shapes, and colors mark extinguishers according to the classes of fires on which they should be used.

TM 8

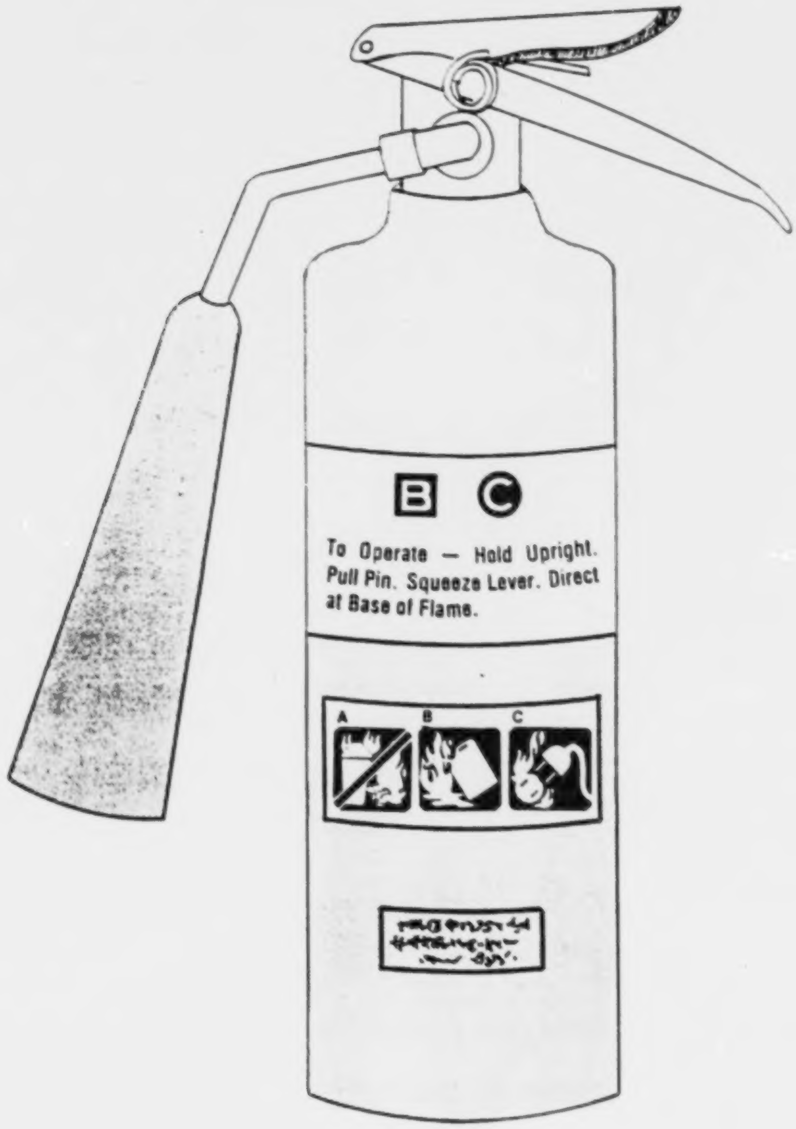
Fire Extinguishers Suitable for Class B and Class C Fires

Symbols with blue backgrounds indicate fire extinguisher can be used for class of fire portrayed.


A TRASH•WOOD•PAPER
B LIQUIDS•GREASE
C ELECTRICAL EQUIP

Symbols with red line across a black background indicate fire extinguisher *cannot* be used for class of fire portrayed.

New Pictorial Symbols Used to Label Fire Extinguishers


B
C
To Operate — Hold Upright. Pull Pin. Squeeze Lever. Direct at Base of Flame.
A
B
C

ASSIGNMENT SHEET 1

ORIENTATION TO CONSTRUCTION SAFETY

B 1

Name ______________________________ Score __________

OBJECTIVE 9

Identify job-site safety violations.

INTRODUCTION

One of the first steps to becoming safety conscious is being able to recognize safe on-the-job practices. Completing this assignment sheet will help you become more familiar with some of these practices.

INSTRUCTIONS

Obtain permission to observe a job site for a few hours, and then fill out the checklist below. Write an "X" in the blank before any checklist item that is not being observed on the job site.

Reading Comprehension Skills
- Draw conclusions

Functional Reading Skills
- Follow written instructions

Cognitive Activity Skills
- Identify critical elements/issues

______ 1. Are adequate training and supervision visible?

______ 2. Are emergency telephone numbers posted?

______ 3. Are safety bulletins, posters, and charts displayed?

______ 4. Is knowledge of safety and first aid visible?

______ 5. Are inspection and accident reporting forms available?

______ 6. Is there any evidence of horseplay or scuffling that may tend to create a hazard?

______ 7. Is there any evidence of overloading ladders, scaffolds, or elevators?

______ 8. Is there indication of workers' using intoxicating liquors or drugs?

______ 9. Does all equipment have safety devices and grounds?

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______10. Is the safety dress code being observed by all workers?

______11. Is an adequate work area provided?

______12. Are adequate stairways or elevators provided?

______13. Are adequate walkways and runways provided?

______14. Are ladders and scaffolds used safely?

______15. Are work areas and passageways clear of rubbish, debris, nails, etc?

______16. Is there adequate illumination?

______17. Is protection provided for floor and roof openings?

______18. Is protection provided for trenches and other excavations?

______19. Is there an adequate parking area?

______20. Is there adequate turnaround space?

______21. Are parking areas and drives free from excessive mud and trash?

______22. Is there separate storage for materials?

______23. Are there separate dump areas?

______24. Are toolsheds, office, and other structures safely and conveniently located?

______25. Are power sources, high-voltage lines, and other electrical equipment located for safety and convenience?

______26. Are sanitary facilities, first-aid stations, and drinking water located for safety and convenience?

______27. Are safety materials and equipment on the job in good condition, and are they convenient when needed?

______28. Is there proper auxiliary equipment for handling materials available on the job site?

______29. Is there adequate space for maneuvering vehicles for elevating and handling materials?

______30. Is there adequate space for loading and unloading equipment and materials?

______31. Is there an adequate supply of the right tools for each part of the job?

______32. Is there an adequate number of workers for jobs being performed?

______33. On the blanks below, add any other safety violations or hazardous conditions you may have observed.

ASSIGNMENT SHEET 2

ORIENTATION TO CONSTRUCTION SAFETY

B 1

Name ______________________ Score __________

OBJECTIVE 10

Match types of fire-extinguisher symbols to their given classes of fires.

INTRODUCTION

One of the dangers of working in the construction industry is that the worker is exposed to potential fire hazards. In fact, on most job sites, all four classes of fire are possible. Scrap lumber, rags, packaging, insulation, and other materials present the constant threat of a Class A fire. Class B fires can result from the wide use of gasoline and other flammable substances such as adhesives, paints and thinners, oils, and lubricants. Electrical wiring within the structure, the use of electrical tools and equipment, and the need for exposed outlets and extension cords can create numerous Class C fire hazards. Even Class D metal fires are a possibility because of welding, cutting, and other operations that produce high temperatures. Thus, it is critical that workers be able to determine quickly the source of a fire in order to select the correct fire extinguisher to fight it.

INSTRUCTIONS

Functional Reading Skills

- Follow written instructions
- Interpret graphics and symbols

Cognitive Activity Skills

- Analyze/synthesize information
- Evaluate alternatives

In this assignment, you are presented with descriptions of several fires and are asked to choose the correct extinguisher to use on each fire. List only the minimum type of acceptable fire extinguisher. For example, if a fire is a Class A fire, list only the A-type extinguisher, even though you could use an A, AB, or ABC extinguisher on that particular fire.

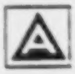
Match the following fire-extinguisher symbols to the given class of fires. Write the correct numbers in the blanks.

______1. Fire in the scrap lumber pile

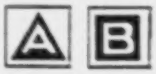
______2. Flames coming from the motor of a radial-arm saw

______3. Metal studs burning near a reinforcement weld

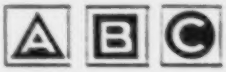
a.



b.



c.



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_____4. Fire caused by cigarette ashes dropping into adhesive spread over a plywood counter top

_____5. Fire near the carburetor of a gasoline-powered electrical generator

_____6. Smoke coming from a barrel of oily rags

_____7. Smoldering insulation around a shorted electrical outlet

_____8. Wood shavings ignited by sparks from a circular saw

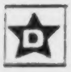
_____9. Electric spray painter ignites

_____10. Can of paint thinner spills, and the thinner bursts into flames when someone drops a lighted cigarette in it

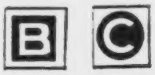
_____11. Space heater being used for winter finish work ignites paneling

_____12. Can of paint thinner explodes into flame, igniting wall containing exposed electrical outlets

d.



e.



ASSIGNMENT ANSWERS

ORIENTATION TO CONSTRUCTION SAFETY

B 1

ASSIGNMENT SHEET 1

Evaluated to the satisfaction of the instructor.

ASSIGNMENT SHEET 2

1. a
2. c
3. d
4. b
5. b
6. b
7. c
8. a
9. e
10. b
11. a
12. e

JOB SHEET 1

ORIENTATION TO CONSTRUCTION SAFETY

B 1

Name ______________________________ Score ________

OBJECTIVE 11

Properly lift a heavy object.

INTRODUCTION

Lifting heavy objects the incorrect way is one of the most common reasons for back problems. By using the following procedures you will learn the correct way to lift and possibly eliminate back problems and loss of time.

TOLS AND MATERIALS

- Heavy object (In this case, a box of nails.)

PROCEDURE

Functional Reading Skills
- Follow written instructions

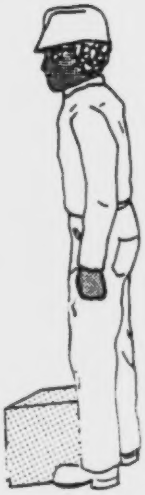
General Relating Skills
- Apply information to life experiences

Job Acquisition/ Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

Yes No

1. Set up to object; place one foot besdide object and one behind object. ___ ___

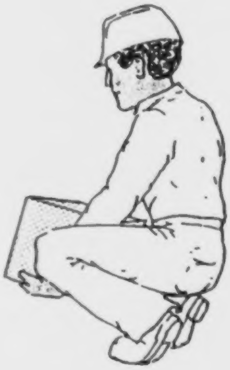
FIGURE 13



Yes No

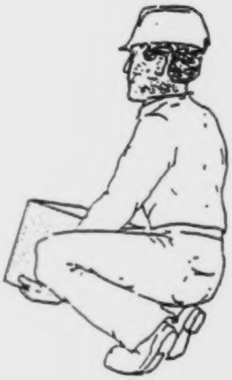
2. Bend down and grasp object with both hands. (Figure 14) ___ ___

FIGURE 14



3. Tuck in chin. (Figure 15) ___ ___

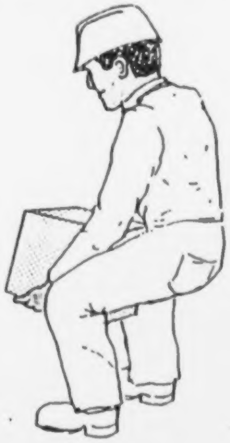
FIGURE 15



Yes No

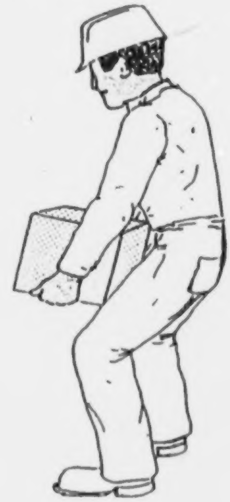
4. Tuck in elbows and arms. (Figure 16 ___ ___

FIGURE 16



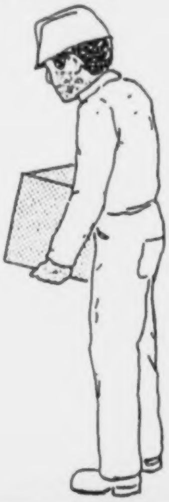
5. Hold load close to body. (Figure 17) ___ ___

FIGURE 17



	Yes	No
6. Keep back straight and body weight directly over feet as you stand up.	___	___

FIGURE 18



(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Properly lifted a heavy object	4	3	2	1
Time standard for a 4 rating is 10 minutes or less	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** – Can perform job with no additional training
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill
1 **Unskilled** – Is familiar with process, but is unable to perform job

WRITTEN TEST

ORIENTATION TO CONSTRUCTION SAFETY

B 1

Name ______________________ Score ________

OBJECTIVE 1

Given a list of safety terms, match them to their correct definitions. Write in the letter that corresponds to the most correct answer.

_____ 1. Which of the following is the best definition of a hazard?

a. A source of danger
b. An obstruction
c. Failure to comply with rules.
d. An on-the-job injury.

_____ 2. What is the definition for the acronym "OSHA"?

a. Organization for Safety and Health
b. Operational Safety for Health Association
c. Occupational Safety and Health Act
d. Occupational Security and Health Act

_____ 3. Which of the following OSHA program requires employers to develop specific written programs for job site safety?

a. MSHA
b. HAZCOM
c. MSHA
d. JSSA

_____ 4. A substance or material that is capable of being easily ignited is called

a. pressurized
b. a retardant
c. flammable
d. an irritant

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_____ 5. A sudden occurring, unintentional event that causes injury or property damage is described as a(an)

a. accident
b. contamination
c. exposure
d. hazard

_____ 6. What is the term used to describe the freedom from danger, risk, or injury?

a. Exposure
b. Awareness
c. Rules
d. Safety

OBJECTIVE 2 **Choose appropriate reasons for safety consciousness on the job.**

_____ 1. Which of the following statements best state the reasons for safety consciousness?

a. To prevent personal injury
b. To allow you to continue providing for your family
c. The safety and welfare of your co-workers.
d. All the above could be valid reasons for safety consciousness.

_____ 2. Prevention of accidents could:

a. slow construction progress
b. make your company less competitive
c. reduce insurance rates
d. increase insurance rate

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OBJECTIVE 3 **Select from a list of alternatives, consequences of workers using controlled substances on the job.**

_____ 1. The consequences of using controlled substances on the job includes

a. an increased safety hazard
b. greater productivity
c. improved job security
d. less tardiness

OBJECTIVE 4 **Given proper and improper safety precautions, choose the correct alternative.**

_____ 1. What action should you take should a minor accident occur at the job site?

a. Ignore it and continue to work.
b. It depends on the severity.
c. Report it to your supervisor.
d. Tell your co-worker.

_____ 2. Which of the following statements is considered an improper safety act?

a. Encourage your co-workers to be safety conscious.
b. Wear your ring when working.
c. Wear safety shoes.
d. Protect your exposed skin from sunlight.

_____ 3. Which of the following is a proper procedure to start a gasoline powered engine that fails to start?

a. Try pouring gasoline into the carburetor.
b. Place the equipment "in-gear" before starting.
c. Don't be concerned about the location of a fire extinguisher.
d. Try using a recommended starting fluid.

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_____ 4. Choose the proper safety procedure should your skin come in contact with cement.

a. Wash your skin with water.
b. Use a solvent to clean skin.
c. Ignore the exposure.
d. Use gasoline to wash your skin.

_____ 5. Which of the following safety procedures should be exercised when working from a scaffold?

a. Observe OSHA regulations.
b. Install according to manufacturer's recommendations.
c. Do not overload scaffold.
d. All the above are correct.

_____ 6. When performing an excavation, which of the following safety precautions is necessary?

a. Inspect shoring systems weekly.
b. Increase speed of excavation if tension cracks appear.
c. Keep heavy equipment back from the excavation.
d. Provide steps or ladders every 50 feet when the depth of excavation is 4 feet or more.

OBJECTIVE 5 **Given a color code, match colors to their correct safety application.**

_____ 1. The color "Federal Safety Red" designates:

a. caution
b. danger
c. dangerous parts of equipment
d. location of safety equipment other than fire-fighting equipment

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_____ 2. Which of the following safety applications is designated by the color "Federal Safety Blue"?

a. Used to designate caution against and provide information about machines out of order or under repair.
b. Designate exposed parts of pulleys, gears, rollers, cutting devices, and power saws
c. Designates radiation hazards
d. Designates and marks physical hazards

OBJECTIVE 6 **Provided a list of terms associated with toxic substances, select their correct definitions and exposure consequences.**

_____ 1. A substance having the nature of a poison is called:
a. mist
b. fume
c. toxic
d. contaminate

_____ 2. Which of the following terms is used to describe a smoke, a vapor, or gas?

a. Mist
b. Irritate
c. Solvent
d. Fume

_____ 3. A person exposed to a solvent could experience which of the following consequences?

a. Mild irritation
b. Severe damage
c. A terminal condition
d. Any or all of the above

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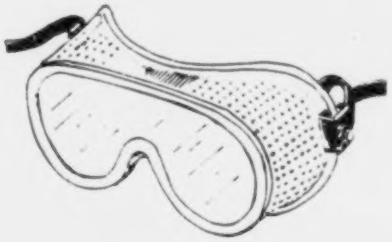
OBJECTIVE 7 **Given alternatives, select the correct reasons for the use of Material Safety Data Sheets (MSDS).**

_____ 1. Which of the following statements best states the reasons for use of MSDS?

a. They describe procedures to install related products.
b. They give information necessary for working safely with hazardous chemicals.
c. They provide general safety regulations that are necessary to avoid heavy equipment accidents.
d. They provide employees the necessary procedures to safely handle the transportation of construction equipment.

OBJECTIVE 8 **Given a picture, identify personal safety equipment and their purpose.**

_____ 1. Select the correct purpose of the following personal safety equipment.



a. Goggles to provide protection against the possibility of eye injury
b. Face shield to provide head protection
c. Goggles to provide protection for the entire face
d. Goggles for the protection of the eyes during welding

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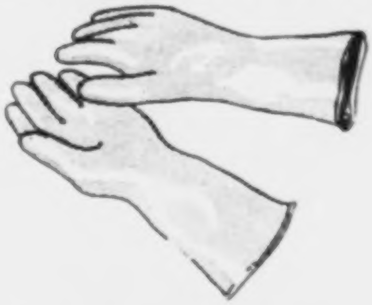
_____ 2. The following picture represents _______________,
which should be used when working with ____________.



a. Rubber gloves, metal bolts
b. Cloth gloves, hazardous materials
c. Rubber gloves, hazardous materials
d. Rubber gloves, any handtool

NOTE: Objectives 10-15 are evaluated on job sheets/assignment sheets in this unit. If you have not completed these components, see your instructor.

May be photocopied for student use.

WRITTEN TEST ANSWERS

ORIENTATION TO CONSTRUCTION SAFETY

B 1

OBJECTIVE 1	1. a	4. c
	2. c	5. a
	3. b	6. d
OBJECTIVE 2	1. d	
	2. c	
OBJECTIVE 3	1. a	
OBJECTIVE 4	1. c	4. a
	2. b	5. d
	3. d	6. c
OBJECTIVE 5	1. b	
	2. a	
OBJECTIVE 6	1. c	
	2. d	
	3. d	
OBJECTIVE 7	1. b	
OBJECTIVE 8	1. a	
	2. c	

OBJECTIVE SHEET

APPLIED CONSTRUCTION MATH *B 2*

INTRODUCTION

This unit is intended to help you better understand mathematical concepts and analytical logic. This unit stresses the importance of accuracy in computational skills and the ability to apply these skills to a wide variety of situations.

UNIT OBJECTIVE

After completing this unit, the student will be able to solve basic math problems. The student will show this knowledge by completing assignment sheets and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to:

1. Given a list of math terms, match them to their correct definitions.
2. Choose the appropriate name for a given mathematical symbol.
3. Select from a list of alternatives, correct solutions to whole number problems. (Assignment Sheet 1)
4. Given choices, pick the correct alternatives to fractional problems. (Assignment Sheet 2)
5. Solve and select correct answers to decimal problems. (Assignment Sheet 3)
6. Provided with a list of alternatives, differentiate between correct and incorrect responses to percentage problems. (Assignment Sheet 4)
7. Make a selection between alternatives, the correct answers to geometric problems. (Assignment Sheet 5)
8. Given alternatives, correctly respond to cubic yard calculations. (Assignment Sheet 6)

9. Solve and select between responses, the correct answers to ratio and proportion problems. (Assignment Sheet 7)

SUGGESTED ACTIVITIES

APPLIED CONSTRUCTION MATH B 2

PREPARATION

- Review unit and plan presentation. Modify time frames to suit class needs and plan activities for each class period.
- Obtain materials to supplement unit.
- Make transparencies from Transparency Masters.
- Order or obtain materials listed in suggested resources.
- Prepare other teaching aids.

DELIVERY

Objective 1: Given a list of math terms, match them to their correct definitions.

- Point out the importance of defining terms for common understanding.

Objective 2: Choose the appropriate name for a given mathematical symbol.

- Discuss symbols used in math problems.
- Prepare examples of problems using the symbols.
- Have students discuss where they have seen the math symbols used.

APPLICATION

Objective 3: Select from a list of alternatives, correct solutions to whole number problems. (Assignment Sheet 1)

- Discuss addition and place values of whole numbers.
- Play "You Inherit" with the students to help them learn place values. Ask students to tell you the least amount they inherit when you give them the amount in numbers of digits.

EXAMPLE: Q. You have just inherited a six-digit sum. What is the least amount you inherit?

A. One hundred thousand dollars

- Develop a set of flash cards containing various subtraction problems. Show students each card and have them give you the correct answer, either orally or written on a sheet of paper.

  NOTE: You may want to prepare similar flash cards for addition, multiplication, and division with whole numbers, fractions, or decimals.

- Obtain or make multiplication table to 12. Have students learn the table.

- For students who consistently cannot make the appropriate decisions to solve long-division exercises, try the "decision-free," step-by-step procedure below.

1. Copy the problem.
2. Draw a vertical line to the right of the problem.
3. Make a guess and write that down to the right of the vertical line.
4. Multiply the guess by the divisor and subtract from the original number.
5. Repeat the process until subtracting produces a number smaller than divisor.

$$\begin{array}{r|r}
52\overline{)86310} & \\
\underline{52000} & 1000 \\
34310 & \\
\underline{20800} & 400 \\
13510 & \\
\underline{10400} & 200 \\
3110 & \\
\underline{2600} & 50 \\
510 & \\
\underline{416} & 8 \\
94 & \\
\underline{52} & \underline{\underline{1}} \\
R = 42 & 1659
\end{array}$$

6. The answer is the sum of the guesses.

7. Check by multiplying the answer times the divisor and adding the remainder. If the problem has been solved correctly, the resulting sum should equal the original number inside the division frame.

EXAMPLE:

1659	Answer
× 52	Divisor
3318	
8295	
86268	
+ 42	Remainder
86310	Sum Equal to Original Number

- Have students complete Assignment Sheet 1.

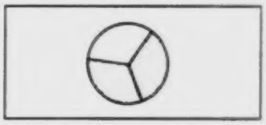
Objective 4: Given choices, pick the correct alternatives to fractional problems. (Assignment Sheet 2)

- Write a proper fraction, such as ³⁄₈, on the chalkboard. Label the fraction's nominator and denominator. Explain that the denominator of this (or any) fraction represents the way the unit has been split. Illustrate this point by drawing on the chalkboard a circle split into eight parts. Now explain that the numerator of this (or any) fraction represents the number of parts involved in the calculation. Therefore the fraction ³⁄₈ indicates three parts of something that has been divided into eight parts. Shade in three of the eight parts of the circle to illustrate this point.

- Make two decks of cards. Show fractions on one deck and the corresponding pictures on the other deck.

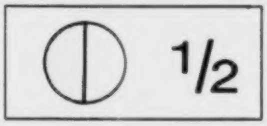
EXAMPLE:

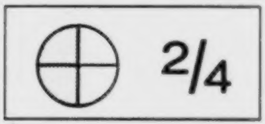
2/3



Cards can also be made to show equivalent fractions, using pictures and fractions.

EXAMPLE:





Students may play a game of matching or rummy by making pairs that match.

- To practice reducing fractions to their lowest terms, prepare twenty-four tagboard flash cards. On each card, write two or three unlike fractions.

EXAMPLES:

1/2 3/8 3/4

3/5 2/3 1/6

Laminate the cards. Have students number their papers from 1 to 24; then give them fifteen seconds to write the least common denominator for the fractions on each flash card shown. To increase the difficulty, shorten the time-span for calculating each lowest common denominator.

- Have students practice measuring with rulers by measuring various items in the classroom: length of books, length and width of desk or table, height of chairs, length of pencil, and so on. Have students record their measurements on a sheet of paper, and then have them convert their measurements to improper fractions. After they have the improper fractions, have them give their lists to another student who then converts the improper fractions to mixed numbers.

- Discuss adding, subtracting, and multiplying fractions.
- Use these flash cards to review addition, subtraction, and multiplication of fractions.
- Complete Assignment Sheet 2.

Objective 5: Solve and select correct answers to decimal problems. (Assignment Sheet 3)

- Discuss place values of decimals.
- Have students write down several decimal numbers. Have students write out the decimal number by place values, i.e., tenths, hundredths, thousandths, ten thousandths.
- Discuss adding and subtracting decimal numbers.
- Emphasize the importance of checking answers.
- Assign a monetary value to each letter of the alphabet: A = $.050, B = $1.00, C = $1.50 . . . Z = $13.00. Then have students calculate such problems as who has the most valuable name?

  NOTE: This activity can be adapted and used to practice multiplication of whole numbers, or for practice with fractions.
- Discuss multiplying decimal numbers.
- Increase student speed in certain multiplication problems by giving timed tests in which the student must use the following shortcuts.

  To multiply by:

  5, 50, 500 etc., just multiply by 10, 100, 1000, etc., and divide by 2;

  25, 250, 2500, etc., just multiply by 100, 1000, 10,000, etc., and divide by 4;

33⅓, 16⅔, 12½, 8⅓, 6¼ multiply by 100 and divide by 3, 6, 8, 12, and 16 respectively.

- Discuss dividing decimal numbers.

- Increase student speed in certain division problems by giving timed tests in which students use the following shortcuts.

  To divide by:

  3⅓, multiply by 3 and divide by 10;

  33⅓, multiply by 3 and divide by 100;
  16⅔, multiply by 6 and divide by 100;

  25, multiply by 4 and divide by 100;

  50, multiply by 2 and divide by 100.

  NOTE: There are other shortcuts that you may want to add to this list and the list of multiplication shortcuts.

- Have students complete Assignment Sheet 3.

Objective 6: Provided with a list of alternatives, differentiate between correct and incorrect responses to percentage problems. (Assignment Sheet 4)

- Discuss fractional equivalents and conversion of fractions and decimals.

- Use Transparencies 1-3 to illustrate fractional and decimal equivalents.

- Before presenting rules for converting fractions to decimals, have students solve problems by converting the decimals to fractions. The answer from the computation with the equivalent fractions must then be converted back to a decimal form. A half dozen exercises like this for each decimal rule may help students appreciate the benefits of learning the rules and why the decimal rules work.

EXAMPLE:

$$5.67 + 3.2 + 4.104 = 5\frac{670}{1000} + 3\frac{200}{1000} + 4\frac{104}{1000}$$

$$= 12\frac{974}{1000}$$

$$= 12.974$$

- Obtain a set of twist drills and a drill index. Take the drills out of the drill index. Have students replace drills in the index, noting the decimal and fractional differences in the drill sizes.

- Obtain a quantity of pocket-sized decimal equivalent charts from your local tool supplier. Give one to each student.

- Illustrate percentages by providing students with graph or grid paper. Have students outline at least eight 10-by-10-block squares. Since each block contains 100 units or small squares, students can shade in enough units to illustrate 25 percent, 33⅓ percent, 50 percent, 96 percent, and so on.

- Have students complete Assignment Sheet 4.

Objective 7: Make a selection between alternatives, the correct answers to geometric problems. (Assignment Sheet 5)

- Discuss terms used in geometry.

- Discuss types of geometric figures.

- Develop a bulletin board display showing types of geometric figures.

- Prepare poster-board cutouts of each geometric figure. As you discuss each figure, attach the cutout to the chalkboard (with masking tape on back) or attach the cutout to a clothesline. When discussion is completed, students will be able to observe the differences among the types of geometric figures.

- Discuss formulas for calculating areas of geometric figures.

- Use Transparencies 4 and 5 to illustrate formulas for figuring the area of a square, a rectangle, or a circle.
- Floor plans of homes can be a source for a variety of mathematical problems. Sample floor plans may be obtained from blueprints of homes, newspapers, or perhaps from old real-estate-agency listings. Some students may prefer to design their own floor plans. Provide students with a floor plan and have them calculate the total square feet in the home and the square feet for each room.
- Have students complete Assignment Sheet 5.

Objective 8: Given alternatives, correctly responsd to cubic yard calculations. (Assignment Sheet 6)

- Discuss calculating the volume of solid figures.
- Visit a construction site before concrete is to be placed. Have students measure forms and determine the volume of concrete that will be needed. You may want to have the students determine the total cost of the concrete also.
- Have students complete Assignment Sheet 6.

Objective 9: Solve and select between responses, the correct answer to ratio and proportion problems. (Assignment Sheet 7)

- Discuss ratio and proportion.
- Use Transparency 6 to illustrate ratio and proportion.
- Have students complete Assignment Sheet 7.

EVALUATION

Pretest

- Give written test as pretest.
- Determine individual study requirements from pretest results.
- Counsel students individually on pretest results and study requirements.

- Modify materials in unit or create supplementary materials for individual student as required.

Skill Test

- Evaluate students on assignment sheet activities.
- Evaluate students on job sheet activities.
- Complete appropriate section of competency profiles.
- Reteach and reevaluate if necessary.
- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Evaluate students on assignment sheet activities.

  NOTE: The written test may be given in sections if desired.

- Give written test.
- Reteach and retest as necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Print Media

- *Speaking of Numbers.* This self-instructional workbook/textbook series is intended for use with two groups of students: 1) beginning English-as-a-Second-Language students who are concurrently studying English and basic mathematic skills; and 2) native speakers of English who require remediation and reinforcement in numbers and arithmetic operations.

NOTE: *Speaking of Numbers* is available from the Institute of Modern Languages, 2622 Pittman Drive, Silver Spring, Maryland 20910.

- *Math.* This book is part of a series of manuals developed specifically for special needs programs for disadvantaged and handicapped students. Seven areas of instruction have assignment sheets specifically designed to acquaint students with basic and practical mathematical problems and terms directly related to vocational skill trades. The guide contains instruction in measurement, whole numbers, fractions, decimals, percentages, consumer education, and geometry.

  NOTE: *Math* is available from the Oklahoma Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074-4364.

OPTIONAL RESOURCES

Software

- *Prevocational Math Review.* Shopware Educational Systems, Dept. KL-5, 101 Hill Road, Aberdeen, WA 98520.

UNIT REFERENCES

- *Math One.* Oklahoma Department of Transportation: Oklahoma City, OK.
- Morrison, Phyllis. *Basic Math Skills.* New York: McGraw-Hill Book Company.
- Willey, Al. *Fundamentals of Carpentry.* Stillwater, Oklahoma: Oklahoma Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center and The Associated General Contractors of America, 1993.

OBJECTIVE 1

Given a list of math terms, match them to their correct definitions.

- **addition** — process of totaling two or more numbers to find another number called a sum

  EXAMPLE: $3 + 5 + 9 = 17$

- **calculate** — to perform a mathematical process

- **caret** — inverted "v" symbol used to indicate where something is to be inserted

- **decimal** — fraction with an unwritten denominator of 10 or some power of 10; indicated with a point before the number

  EXAMPLES:

  $$0.1 = \frac{1}{10}$$

  $$0.06 = \frac{6}{100}$$

  $$0.003 = \frac{3}{1000}$$

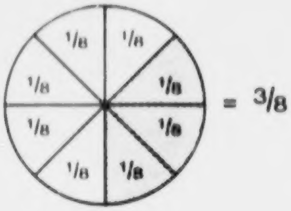
- **digit** — any one of the ten symbols, 0 to 9, by which all numbers can be expressed

- **division** — opposite (inverse) operation of multiplication

  EXAMPLE: $16 \div 2 = 8$ as compared to $8 \times 2 = 16$

- **fraction** — part of a whole; represents one or more equal parts of a unit (Figure 1)

FIGURE 1



- **modular** — pertaining to nominal units based on a standard dimension such as a modular brick which is in a 4" modular

- **multiplication** — abbreviated process of adding a number to itself a specified number of times

  EXAMPLE: 6 × 3 = 18 as compared to 6 + 6 + 6 = 18

- **nominal size** — theoretical size that may vary from the actual

  EXAMPLE: A 2 × 4 stud is actually 1½ inches by 3½ inches.

- **percent** — one part in a hundred; calculated on the basis of a whole divided into one hundred parts

- **problem** — mathematical proposition

- **proportional** — being relatively equal in size or quantity

  EXAMPLE: 1:1:3 = 0.5:0.5:1.5

- **ratio** — relationship in quantity, amount, or size between two or more things

- **rounding** — a method used to mathematically approximate a number

  EXAMPLE: A number rounded to the nearest tenth:

  - 2.21 becomes 2.2
  - 2.25 becomes 2.3
  - 2.28 becomes 2.3

- **subtraction** — opposite (inverse) operation of addition

  EXAMPLE: 8 – 4 = 4 as compared to 4 + 4 = 8

- **whole number (integer)** — any of the natural numbers, both positive and negative

  EXAMPLE: 25 is a whole number as compared to ¾, a fraction or part of a whole.

OBJECTIVE 2 **Choose the appropriate name for a given mathematical symbol.**

TABLE

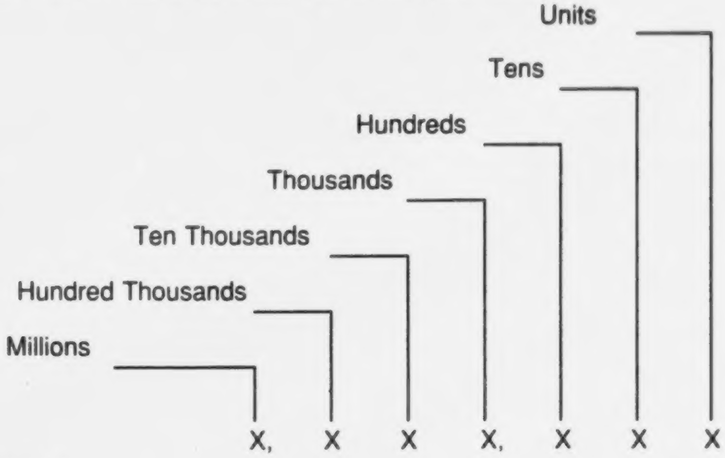
Name of Symbol	Symbol
Plus sign (addition)	+
Minus sign (subtraction)	–
Times sign (multiplication)	×
Division sign	÷
Division frame	$\overline{)}$
Equal sign	=
Decimal point	.
Percent symbol	%
Ratio symbol	:
Pi sign	Π

OBJECTIVE 3

Select from a list of alternatives, correct solutions to whole number problems.

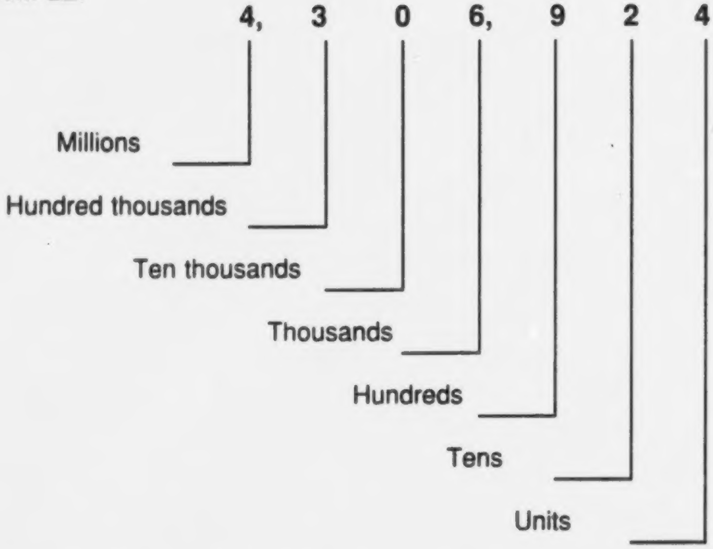
- Place values

NOTE: The position of a digit in a number shows how much that digit is worth. These positions are called *place values.*



Units
Tens
Hundreds
Thousands
Ten Thousands
Hundred Thousands
Millions
X, X X X, X X X

EXAMPLE:



4, 3 0 6, 9 2 4
Millions
Hundred thousands
Ten thousands
Thousands
Hundreds
Tens
Units

NOTE: The number in this example is four million, three hundred six thousand, nine hundred twenty-four.

- Adding whole numbers

1. Set up problem by writing units under units, tens under tens, and so on.

   EXAMPLE: Add the whole numbers 1632, 17, 550.

$$\begin{array}{r} 1632\\ 17\\ +\ 550\\ \hline \end{array}$$

2. Add each column separately, beginning at top of units column.

   EXAMPLE:

$$\begin{array}{r} 1632\\ 17\\ +\ 550\\ \hline 9 \end{array} \qquad \begin{array}{r} 1632\\ 17\\ +\ 550\\ \hline 99 \end{array}$$

3. If the sum of any column is two or more digits, write the units digit in your answer and carrying the remaining digit(s) to the top of next column to the left.

   EXAMPLE:

$$\text{Write units digit.}\quad \begin{array}{r} 1632\\ 17\\ +\ 550\\ \hline \rightarrow 199 \end{array} \qquad \begin{array}{r} 1 \leftarrow\\ 1632\\ 17\\ +\ 550\\ \hline 199 \end{array} \quad \text{Carry remaining digit.}$$

4. Add any carried digit(s) above the column with that column.

   EXAMPLE:

$$\begin{array}{r} 1\\ 1632\\ 17\\ +\ 550\\ \hline 2199 \end{array} \quad \text{Carried Digit}$$

- Subtracting whole numbers

  1. Set up problem by writing units under units, tens under tens, and so on.

     NOTE: The top number in the problem [original number] is almost always larger than the bottom number [subtracted number].

     EXAMPLE: Subtract 91 from 123.

     $$\begin{array}{rl} 123 & \text{Original Number} \\ \underline{-\ 91} & \text{Subtracted Number} \end{array}$$

  2. Subtract each column separately, beginning at bottom of units column.

     EXAMPLE:

     $$\begin{array}{r} 123 \\ \underline{-\ 91}\uparrow \\ 2 \end{array}$$

  3. If a digit in the subtracted number is larger than the digit above it, "borrow" 1 from the top digit in the next column to the left, decreasing that digit by one and increasing the digit being subtracted by ten.

     EXAMPLE:

     $$\begin{array}{r} 123 \\ \underline{-\ 91} \\ 32 \end{array}$$

  4. If there is nothing to borrow in the next left column (column contains a zero), first borrow for that column from its next left column.

     EXAMPLE:

     $$\begin{array}{r} 906 \\ \underline{-318} \\ \end{array} \qquad \begin{array}{r} 906 \\ \underline{-318} \\ 8 \end{array} \qquad \begin{array}{r} 906 \\ \underline{-318} \\ 88 \end{array} \qquad \begin{array}{r} 906 \\ \underline{-318} \\ 588 \end{array}$$

5. Check your subtraction by adding your answer to the subtracted number.

EXAMPLE:

	Problem		Check
271	Original Number	271	Original Number
- 164	Subtracted Number	- 164	
107	Answer	+ 107	
		271	Check Answer

NOTE: If you have solved the problem correctly, your check answer should be the same as the original number.

- Multiplying whole numbers

1. Set up problem by writing the larger number (original number) above the smaller number (multiplier), writing units under units, tens under tens, and so on.

   NOTE: You will get the correct answer [product] no matter which number is placed above the other, but the faster method places the larger above the smaller.

   EXAMPLE: Multiply the numbers 53 and 4.

53	Original Number
× 4	Multiplier

2. If the multiplier contains only one digit, multiply each digit in the original number by it, working from right to left.

   a. Multiply units digit in original number by multiplier.

   EXAMPLE:

$$\begin{array}{r} 53 \\ \uparrow \\ \times\ 4 \\ \hline 2 \end{array}$$

b. Write answer units digit and insert necessary carry digit above next left column in original number as required.

c. Multiply tens digit by multiplier and add carried digit as required.

EXAMPLE:

$$\begin{array}{r} 53 \\ \underline{\times\ 4} \\ 212 \end{array}$$

3. If the multiplier contains more than one digit, find partial products.

a. Multiply each digit in original number by each digit in multiplier, moving from right to left.

b. Align partial products so that right-hand digit of each is directly under its corresponding digit in the multiplier.

EXAMPLE: Multiply the numbers 174 and 42

$$\begin{array}{rrrrrr} 174 & 174 & 174 & 174 & 174 & 174 \\ \uparrow & & & & \uparrow & \\ \underline{\times\ 42} & \underline{\times\ 42} & \underline{\times\ 42} & \underline{\times\ 42} & \underline{\times\ 42} & \underline{\times\ 42} \\ 8 & 48 & 348 & 348 & 348 & 348 \\ & & & 6 & 96 & 696 \\ & & \uparrow & & & \uparrow \\ & & \text{First Partial} & & & \text{Second Partial} \\ & & \text{Product} & & & \text{Product} \end{array}$$

4. Add the partial products.

EXAMPLE:

$$\begin{array}{r} 174 \\ \underline{\times\ 42} \\ 348 \\ \underline{+\ 696\ } \\ 7308 \end{array}\ \text{Answer (Product)}$$

- Dividing whole numbers

1. Set up problem by writing original number (number to be divided) inside a division frame, and by writing divisor (number you are dividing by) outside frame.

   EXAMPLE: How many times will 33 go into 3347?

   $$\text{Divisor } 33\overline{)3347} \text{ Original Number}$$

2. Determine how many times the divisor will go into the first digit of the original number, if it will not, write a zero in the answer space directly above the first digit, and then determine how many times the divisor will go into the first two numbers of the original number.

   NOTE: Continue trying to divide the original number by the divisor until a set of digits can be divided. Remember to write a zero each time the set of digits cannot be divided.

   EXAMPLE:

   $$\begin{array}{r} 0 \\ 34\overline{)3347} \end{array} \quad \text{34 goes into 3 zero times.}$$

   $$\begin{array}{r} 00 \\ 34\overline{)3347} \end{array} \quad \text{34 goes into 33 zero times.}$$

   $$\begin{array}{r} 009 \\ 34\overline{)3347} \end{array} \quad \text{34 goes into 334 nine times.}$$

3. Multiply the divisor by the answer (digit above frame); write this answer under the digit(s) that divisor went into, and subtract.

EXAMPLE:

$$\begin{array}{r} 34 \\ \underline{\times\ 9} \\ 306 \end{array}$$

Multiply divisor (34) by answer (9).

$$\begin{array}{r} \underline{009\ } \\ 34\overline{)3347} \\ -\ \underline{306} \\ 28 \end{array}$$

Write answer under 334, the digits divisor went into, and subtract.

4. Bring down next unused digit from original number, and place it to the right of the subtracted difference (remainder)—even if the remainder is zero.

EXAMPLE:

$$\begin{array}{r} \underline{009} \\ 34\overline{)3347} \\ \underline{306\downarrow} \\ 287 \end{array}$$

5. Determine how many times the divisor will go into this new number; write your answer in the answer space above the digit that was brought down.

EXAMPLE:

$$\begin{array}{r} \underline{0098} \\ 34\overline{)3347} \\ \underline{306} \\ 287 \end{array}$$

6. Multiply the divisor by the last digit you wrote in the answer; write this product under the digits that divisor went into, and subtract.

EXAMPLE:

$$\begin{array}{r} 34 \\ \underline{\times\ 8} \\ 272 \end{array}$$

Multiply divisor (34) by last digit of answer (8).

$$\begin{array}{r} \underline{0098} \\ 34)3347 \\ \underline{306\ } \\ 287 \\ -\ \underline{272} \\ 15 \end{array}$$

Write product under 287, the digits that divisor went into, and subtract.

7. Continue this process until all numbers in the original number are used

8. Write any remaining subtracted difference as a remainder

EXAMPLE:

$$\begin{array}{rl} \underline{0098} & \\ 34)3347 & \\ \underline{306\ } & \\ 287 & \\ \underline{272} & \\ 15 & \text{Remainder} \end{array}$$

9. Check your answer by multiplying your answer times the divisor and adding the remainder to this number

   NOTE: If you have solved the problem correctly, your check answer should be the same as your original number.

EXAMPLE:

$$\begin{array}{rl} 98 & \text{Answer} \\ \underline{\times 34} & \text{Divisor} \\ 392 & \\ \underline{294\ } & \\ 3332 & \\ \underline{+\ \ 15} & \text{Remainder} \\ 3347 & \text{Check Answer (Same as original number)} \end{array}$$

OBJECTIVE 4

Given choices, pick the correct alternative to fractional problems.

- Terms used with fractions
  - **Proper** — Top number of fraction (numerator) is smaller than bottom number of fraction (denominator)

    EXAMPLE: $\begin{matrix} 7 \\ \hline 8 \end{matrix} \begin{matrix} \text{Numerator} \\ \text{Denominator} \end{matrix}$

  - **Improper** — Top number of fraction (numerator) is equal to or larger than bottom number of fraction (denominator)

    EXAMPLES: $\frac{9}{8}$ $\frac{16}{16}$

  - **Mixed numbers** — Contains a whole number and a proper fraction

    EXAMPLES: 9½, 1⅞, 4¾

- Reducing fractions to lowest terms
  - Divide the numerator and denominator by the largest whole number that will go into each evenly.

    EXAMPLE: Reduce $\frac{4}{16}$ to its lowest terms.

    $$\frac{4}{16} = \frac{4 \div 4}{16 \div 4} = \frac{1}{4}$$

    NOTE: The fraction ¼ is reduced to its lowest term because the numerator [1] and the denominator [4] cannot be divided by the same number.

- Converting mixed numbers to improper fractions

  1. Multiply the whole number by the denominator of the fraction.

     EXAMPLE: Convert $4\frac{3}{8}$ to an improper fraction.

     $8 \times 4 = 32$

  2. Add your answer to the numerator.

     EXAMPLE: $32 + 3 = 35$

  3. Place this sum over the original denominator.

     EXAMPLE: $\frac{35}{8}$ Improper Fraction

- Converting improper fractions to mixed numbers

  1. Divide the numerator by the denominator.

     EXAMPLE: Convert $\frac{18}{15}$ to a mixed number.

$$\begin{array}{rl} 01 & \\ 15\overline{)18} & \\ \underline{15} & \\ 3 & \text{Remainder} \end{array}$$

  2. Place the remainder over the denominator.

     EXAMPLE: $\frac{3}{15}$ Remainder / Denominator

  3. Reduce this fraction if necessary.

     EXAMPLE: $\frac{3}{15} = \frac{3 \div 3}{15 \div 3} = \frac{1}{5}$

  4. Add the reduced fraction to the whole number obtained by dividing the numerator by the denominator.

EXAMPLE: $1 + \frac{1}{5} = 1\frac{1}{5}$ Mixed Number

- Adding fractions

  — Like fractions

  NOTE: Like fractions are those having the same, or common, denominators.

  EXAMPLES: ¼ and ¾, ⅝ and ⅝, and $\frac{1}{16}$ and $\frac{1}{16}$

  1. Add the numerators.
  2. Place sum of numerators over common denominator.
  3. Convert to mixed numbers and reduce as required.

  EXAMPLE 1: Add ¼ and ¾.

$$\frac{1}{4} + \frac{2}{4} = \frac{1+2}{4} = \frac{3}{4}$$

  EXAMPLE 2: Add ⅝ and ⅝.

$$\frac{5}{8} + \frac{5}{8} = \frac{5+5}{8} = \frac{10}{8} = 10 \div 8 = 1\frac{2}{8} = 1\frac{1}{4}$$

  EXAMPLE 3: Add $\frac{1}{16}$ and $\frac{3}{16}$.

$$\frac{1}{16} + \frac{3}{16} = \frac{1+3}{16} = \frac{4}{16} = \frac{4 \div 4}{16 \div 4} = \frac{1}{4}$$

— Unlike fractions

EXAMPLES: $\frac{11}{12}$ and $\frac{3}{9}$, $\frac{1}{8}$ and $\frac{3}{4}$

1. Change to like fractions.

    a. Find the lowest number into which each denominator can be divided evenly (lowest common denominator).

    b. Multiply the numerators and denominators of each fraction by the number of times its denominator can be divided into the lowest common denominator.

    EXAMPLE 1: Add $\frac{11}{12}$ and $\frac{3}{9}$.

    36 is lowest number into which both 12 and 9 can be divided evenly.

    $$36 \div 12 = 3$$

    $$36 \div 9 = 4$$

    $$\frac{11}{12} = \frac{11 \times 3}{12 \times 3} = \frac{33}{36}$$

    $$\frac{3}{9} = \frac{3 \times 4}{9 \times 4} = \frac{12}{36}$$

    EXAMPLE 2: Add $\frac{1}{8}$ and $\frac{3}{4}$.

    8 is the lowest number into which both 8 and 4 can be divided evenly.

$$8 \div 8 = 1$$

$$8 \div 4 = 2$$

$\frac{1}{8}$ remains as 1/8 because 8 is the common denominator.

$$\frac{3}{4} = \frac{3 \times 2}{4 \times 2} = \frac{6}{8}$$

2. Add like fractions and reduce or convert to mixed numbers as required.

EXAMPLE 1: Add $\frac{11}{12}$ and $\frac{3}{9}$.

$$\frac{11}{12} = \frac{33}{36} \text{ and } \frac{3}{9} = \frac{12}{36}$$

$$\frac{33}{36} + \frac{12}{36} = \frac{33 + 12}{36} = \frac{45}{36} = \frac{5}{4} = 1\frac{1}{4}$$

EXAMPLE 2: Add $\frac{1}{8}$ and $\frac{3}{4}$.

$$\frac{1}{8} \text{ remains } \frac{1}{8} \text{ and } \frac{3}{4} = \frac{6}{8}$$

$$\frac{1}{8} + \frac{6}{8} = \frac{1 + 6}{8} = \frac{7}{8}$$

- Mixed numbers

  1. Add whole numbers.
  2. Add fractions, first finding common denominators if necessary, and reduce or convert to mixed numbers as necessary.

3. Add the sums of steps 1 and 2.

EXAMPLE 1: Add $3\frac{1}{8}$ and $7\frac{3}{8}$.

$3 + 7 = 10$ Add whole numbers.

$\frac{1}{8} + \frac{3}{8} = \frac{1 + 3}{8} = \frac{4}{8} = \frac{1}{2}$ Add fractions and reduce.

$10 + \frac{1}{2} = 10\frac{1}{2}$ Add the sums of steps 1 and 2.

EXAMPLE 2: Add $4\frac{2}{3}$ and $1\frac{5}{6}$.

$4 + 1 = 5$ Add whole numbers.

$\frac{2}{3} + \frac{5}{6} = \frac{4}{6} + \frac{5}{6}$ Find common denominator.

$\frac{4}{6} + \frac{5}{6} = \frac{9}{6} = 1\frac{3}{6} = 1\frac{1}{2}$ Add fractions, convert to mixed number, and reduce.

$5 + 1\frac{1}{2} = 6\frac{1}{2}$ Add sums of steps 1 and 2.

- Subtracting fractions

  — Like fractions

  1. Subtract smaller numerator from larger numerator.

     EXAMPLE: Subtract $\frac{1}{16}$ from $\frac{7}{16}$.

     $7 - 1 = 6$

  2. Place subtraction answer over common denominator.

     EXAMPLE: $\frac{6}{16}$

3. Reduce to lowest terms as required.

   EXAMPLE: $\frac{6}{16} = \frac{3}{8}$

— Unlike fractions

1. Change to like fractions.

   EXAMPLE: Subtract ½ from ¾.

   $\frac{3}{4}$ remains the same because 4 is the common denominator.

   $$\frac{1}{2} = \frac{1 \times 2}{2 \times 2} = \frac{2}{4}$$

2. Subtract as for like fractions.

   EXAMPLE: $\frac{3}{4} - \frac{2}{4} = \frac{3-2}{4} = \frac{1}{4}$

3. Reduce to lowest terms as required.

- Subtracting mixed numbers

1. Convert mixed numbers to like fractions.

   EXAMPLE: Subtract 3½ from 5⅛

   $$5\frac{1}{8} - 3\frac{1}{2} =$$

   $$5\frac{1}{8} - 3\frac{4}{8}$$

2. Borrow a one from the original whole number if needed, convert the one to a like fraction, and add it to the smaller fraction.

NOTE: This step is needed only if the like fraction in the original number is smaller than the like fraction in the subtracted number.

EXAMPLE:

$$5\frac{1}{8} - 3\frac{4}{8} = (4\frac{8}{8} + \frac{1}{8}) - 3\frac{4}{8}$$

$$= 4\frac{9}{8} - 3\frac{4}{8}$$

3. Subtract whole number from whole number and like fraction from like fraction

EXAMPLE:

$$4\frac{9}{8} - 3\frac{4}{8} = 1\frac{5}{8}$$

- Multiplying fractions

1. Convert mixed numbers to improper fractions if necessary.
2. Multiply numerators by numerators and denominators by denominators.
3. Write the product of the numerators over the product of the denominators.
4. Convert improper fractions to mixed numbers and reduce as required.

EXAMPLE 1: Multiply ½ by ¾.

$$\frac{1}{2} \times \frac{3}{4} = \frac{1 \times 3}{2 \times 4} = \frac{3}{8}$$

EXAMPLE 2: Multiply 1¼ by ½.

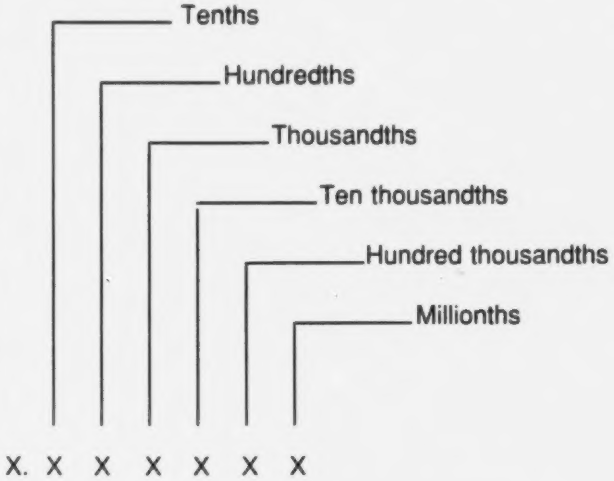
$1\frac{1}{4} = \frac{5}{4}$ Convert to improper fraction.

$$\frac{5}{4} \times \frac{1}{2} = \frac{5 \times 1}{4 \times 2} = \frac{5}{8}$$

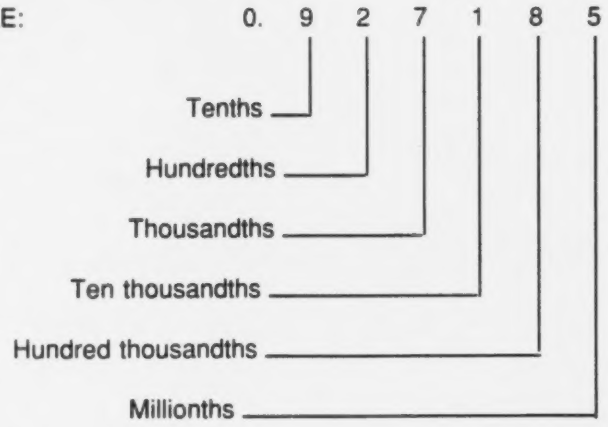
OBJECTIVE 5

Solve and select correct answers to decimal problems.
(Assignment Sheet 3)

- Place values for decimal numbers


Tenths
Hundredths
Thousandths
Ten thousandths
Hundred thousandths
Millionths
X. X X X X X X

EXAMPLE:


0. 9 2 7 1 8 5
Tenths
Hundredths
Thousandths
Ten thousandths
Hundred thousandths
Millionths

NOTE: The number in the example is read as nine hundred twenty-seven thousand, one hundred eighty-five millionths.

- Adding decimal numbers

1. Set up problem as for addition of whole numbers, aligning decimal points directly under each other.

   NOTE: Zeros may be added to ensure that units line up under units, tens under tens, and so on. Whole numbers have an understood decimal point to the right of the units digit: 7 is 7., 75 is 75., and 754 is 754.

   EXAMPLE: Add 0.857, 2.1, 753, and 370.057.

$$\begin{array}{r@{.}l} 0&857 \\ 2&1 \\ 753& \\ \underline{+\ 370}&\underline{057} \end{array} \qquad \text{or} \qquad \begin{array}{r} 000.857 \\ 002.100 \\ 753.000 \\ \underline{+\ 370.057} \end{array}$$

2. Add each column of numbers as for whole numbers.

3. Locate the decimal point in the answer by placing it directly under the decimal points above.

   EXAMPLE:

$$\begin{array}{rl} 000.857 & \\ 002.100 & \\ 753.000 & \\ \underline{+\ 370.057} & \\ 1126.014 & \text{Answer} \end{array}$$

- Subtracting decimal numbers

1. Set up problem as for subtraction of whole numbers, aligning decimal points directly under each other.

   EXAMPLE: Subtract 1.397 from 8.120.

$$\begin{array}{rl} 8.120 & \text{Original Number} \\ \underline{-\ 1.397} & \text{Subtracted Number} \end{array}$$

2. Subtract each column of numbers as for whole numbers.

3. Locate the decimal point in the answer by placing it directly under the decimal points above.

4. Check your subtraction by adding your answer to the subtracted number.

   NOTE: If you have solved the problem correctly, your check answer should be the same as the original number.

   EXAMPLE:

8.120	Original Number
− 1.397	Subtracted Number
+ 6.723	Answer (Difference)
8.120	Check Answer

- Multiplying decimal numbers

1. Set up problem and multiply as for multiplication of whole numbers.

   NOTE: Do *not* align the decimal points in columns when setting up multiplication problems for decimal numbers.

   EXAMPLE: Multiply 27.935 by 7.07.

27.935	Original Number
× 7.07	Multiplier
195545	
00000	
195545	
19750045	

2. Count the number of decimal places to the right of the decimal points in the multiplier and original number.

   EXAMPLE:

27.935	3	Decimal Places
× 7.07	+2	Decimal Places
	5	Total Decimal Places

3. Locate decimal point in answer by beginning at far right digit and counting off as many places to the left as the total decimal places found in step 2.

EXAMPLE:

$$\begin{array}{r} 27.935 \\ \underline{\times\ \ 7.07} \\ 195545 \\ \underline{1955450\ } \\ 197.50045 \end{array} \quad \text{5 Decimal Places}$$

- Dividing decimal numbers

  1. Set up problem as for division of whole numbers.

     EXAMPLE: Divide 0.25 by 0.005.

     Divisor $0.005\overline{)0.25}$ Original Number

  2. Move the decimal point in the divisor to the right of the far right digit in the divisor.

     EXAMPLE: $0.005.\overline{)0.25}$

  3. Move the decimal point in the original number to the right by the same number of decimal places that you moved the decimal point in the divisor, adding zeros to the original number if necessary.

     EXAMPLE: $0.005.\overline{)0.250.}$

     NOTE: If you are dividing a decimal number into a whole number, remember that whole numbers have an understood decimal point to the right of the units digit.

     EXAMPLE: $0.03\overline{)9}$ becomes $0.03.\overline{)9.00.}$

  4. Place a decimal point in the answer space directly above the repositioned decimal point in the original number.

     EXAMPLE: $0.005.\overline{)0.250.}$

5. Divide as for whole numbers.

EXAMPLE:

$$\begin{array}{r} 50. \\ 0005.\overline{)0250.} \\ \underline{025} \\ 00 \end{array}$$

6. Check your division by multiplying the original divisor (before decimal point was moved) by your answer and adding any remainder to this number.

NOTE: If you have solved the problem correctly, your check answer should be the same as the original number.

EXAMPLE:

0.005	Divisor
× 50	Answer
0.250	Check Answer (Same as original number)

- Converting decimal fractions to common fractions

1. Remove the decimal point.
2. Place number over its respective denominator (10's, 100's, 1000's).
3. Cancel zeros when possible.
4. Reduce to lowest term.

EXAMPLE: Convert .25 to a common fraction

$$.25 = \frac{25}{100}$$

$$= \frac{1}{4}$$

EXAMPLE: Convert .520 to a common fraction

$$.520 = \frac{520}{1000}$$

$$= \frac{520}{1000} = \frac{52}{100}$$

$$= \frac{13}{25}$$

- Converting common fractions to decimals and percentages

1. Fractions to decimals — Divide the numerator by the denominator.

   EXAMPLE: Convert $\frac{5}{8}$ to a decimal.

   $$\frac{5}{8} \quad \begin{array}{l} \text{Numerator} \\ \text{Denominator} \end{array} \qquad \begin{array}{r} 0.625 \\ 8\overline{)5.000} \\ \underline{4\,8} \\ 20 \\ \underline{16} \\ 40 \\ \underline{40} \\ 0 \end{array}$$

2. Converting fractions to percentages

   NOTE: Percent means that a number is a fraction of 100.

   a. Convert the fractions to decimals by dividing the numerator by denominator.

   b. Move the decimal point in the answer two places to the right.

c. Place the percent symbol after the number.

EXAMPLE: Convert $\frac{7}{33}$ to a percentage.

$$\frac{7}{33}\ \begin{array}{l}\text{Numerator} \\ \text{Denominator}\end{array}$$

$$\begin{array}{r} 0.2121 \\ 33\overline{)7.0000} \\ \underline{6\,6} \\ 40 \\ \underline{33} \\ 70 \\ \underline{66} \\ 40 \\ \underline{33} \\ 7 \end{array} = 21.21\%$$

- Common fractions to decimal equivalents

1/64	.015625	33/64	.515625
1/32	.03125	17/32	.53125
3/64	.0468752	35/64	.546875
1/16	.0625	9/16	.5625
5/64	.078125	37/64	.578125
3/32	.09375	19/32	.59375
7/64	.109375	39/64	.609375
1/8	.125	5/8	.625
9/64	.140625	41/64	.640625
5/32	.15625	21/32	.65625
11/64	.171875	43/64	.671875
3/16	.1875	11/16	.6875
13/64	.203125	45/64	.703125
7/32	.21875	23/32	.71875
15/64	.234375	47/64	.734375
2/8	.25	3/4	.75
17/64	.265625	49/64	.765625
9/32	.28125	25/32	.78125
19/64	.296875	51/64	.796875
5/16	.3125	13/16	.8125
21/64	.328125	53/64	.828125
11/32	.34375	27/32	.84375
23/64	.359375	55/64	.859375
3/8	.375	7/8	.875
25/64	.390625	57/64	.890625
13/32	.40625	29/32	.90625
27/64	.421875	59/64	.921875
7/16	.4375	15/16	.9375
29/64	.453125	61/64	.953125
15/32	.46875	31/32	.96875
31/64	.484375	63/64	.984375
1/2	.5	8/8	1.

OBJECTIVE 6 **Provided with a list of alternatives, differentiate between correct and incorrect responses to percentage problems.**

- Converting percentages
  - Percentages to fractions
    1. Drop the percent symbol.
    2. Place the number over 100.
    3. Reduce to lowest terms if necessary.

EXAMPLE: Convert 38% to a fraction.

$$38\% = \frac{38}{100}$$

$$= \frac{19}{50}$$

  - Percentages to decimals
    1. Drop the percent symbol.
    2. Move decimal point two places to left.

EXAMPLE: Convert 74% to a decimal.

74% = 0.74

- Solving percentage problems

  NOTE: Percentage problems may involve solving for the percent ("16 is what percent of 80?"), the part ("What number is 20% of 80?"), or the whole ("16 is 20% of what number?").

  1. Write the unknown as "X".

     EXAMPLE: 6 is what percent of 80?

     16 is X percent of 80.

     NOTE: The unknown may be the percent, the part, or the whole.

  2. Write the percent (known or unknown) as a fraction with a denominator of 100.

     EXAMPLE: 16 is $\frac{X}{100}$ percent of 80.

  3, Write the part and the whole as a fraction, writing the part as the numerator and the whole as the denominator.

     EXAMPLE: $\frac{16}{80}$ $\frac{\text{Part}}{\text{Whole}}$

  4. Set up the equation by writing the two fractions with an equal sign between them.

     EXAMPLE: $\frac{X}{100} = \frac{16}{80}$

  5. Solve the equation by multiplying the numerator of each fraction by the denominator of the other.

     NOTE: This process is known as *cross multiplying.*

     EXAMPLE:

     $$\frac{X}{100} = \frac{16}{80}$$

     $$80X = 1600$$

6. Divide each side of the equation by the multiplier of X.

EXAMPLE: $80X = 1600$

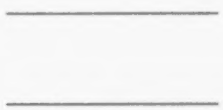
$X = 20\%$

16 is 20% of 80.

OBJECTIVE 7 **Make a selection between alternatives, the correct answers to geometric problems.**

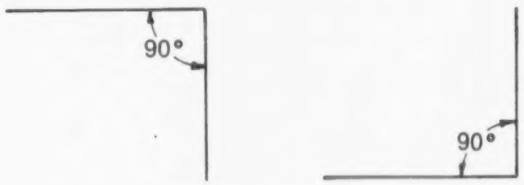
- Geometry terms
  - **geometric figure** — shape formed by straight or curved lines
  - **perimeter** — outer limits or boundary
  - **lineal** — relating to a straight line
  - **parallel** — equal distance apart and never meeting (Figure 2)

FIGURE 2



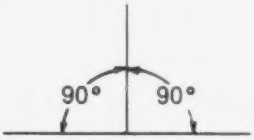
- **right angle** — angle formed by two lines perpendicular to each other; 90 degree angle (Figure 3)

FIGURE 3



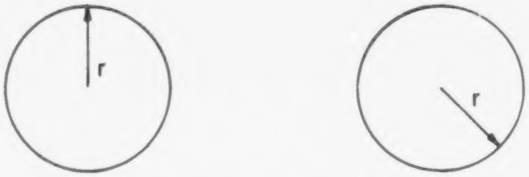
- **perpendicular** — line or surface at right angle to another line or surface (Figure 4)

FIGURE 4



- **radius** — line from center of a circle to any point on edge of circle (Figure 5)

FIGURE 5



- **diameter** — distance between outer edges of a circle through center point (Figure 6)

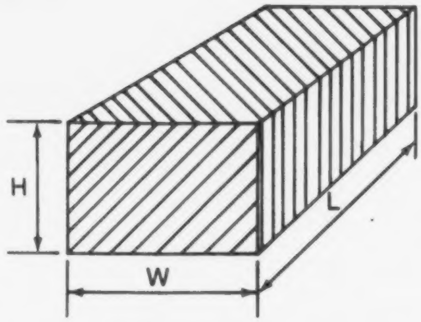
FIGURE 6

- **circumference** — distance around outer edge of circle
- **pi** — Greek letter (∏) representing ratio of a circle's circumference to its diameter; ratio approximately 3.1416
- **area** — measure of a flat surface; expressed in square units

EXAMPLE: W × L = Area in square units

- **volume** — space occupied by a body; expressed in cubic units (Figure 7)

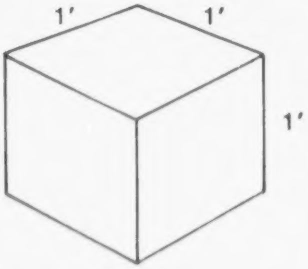
FIGURE 7



- **cubic unit of measurement** — unit with three equal dimensions including length, width, and height

- **cubic foot** — volume of an object that is 1 foot long, 1 foot wide, and 1 foot high (Figure 8)

FIGURE 8



- Types of geometric figures
  - **square** — figure having four sides of equal length and four right angles

FIGURE 9

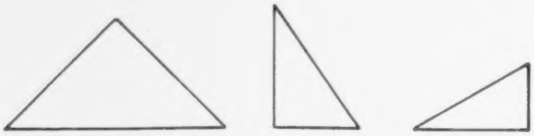
262

- **rectangle** — figure with two parallel ends of equal length, two parallel sides of equal length, and four right angles

FIGURE 10

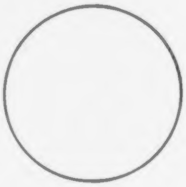
- **triangle** — figure having three sides and three angles

FIGURE 11



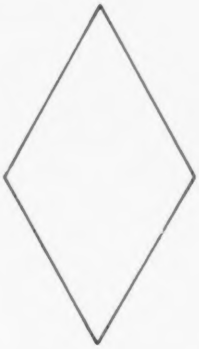
- **circle** — flat, round figure formed by one curved line; all points of curved line are equidistant from center point

FIGURE 12



- **rhombus** — figure having no right angles and four sides of equal length

FIGURE 13

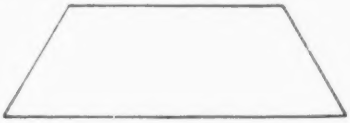


- **parallelogram** — figure with two parallel ends of equal length and two parallel sides of equal length

FIGURE 14

- **trapezoid** — figure with only one pair of parallel opposite sides

FIGURE 15

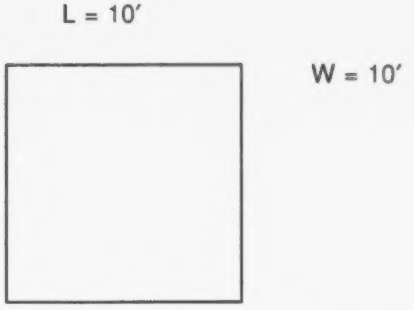


- Calculating the area of geometric figures

  NOTE: Area is always labeled in square units of measure.

- **square** — use the formula Area = Length × Width or A = LW

FIGURE 16



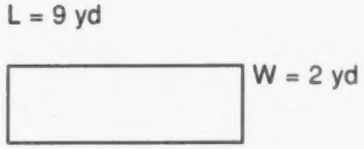
$A = LW$

$= 10 \times 10$

= 100 square feet

- **rectangle** — use the formula Area = Length × Width or A = LW

FIGURE 17



$A = LW$

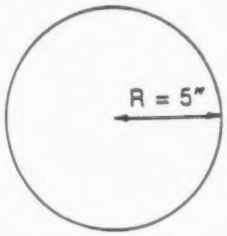
$= 9 \times 2$

= 18 square yards

- **circle** — use the formula Area = Πr^2 (radius × radius)

  NOTE: Pi $[\Pi]$ is 3.14, which is the circumference of a circle divided by the diameter of the circle.

FIGURE 18



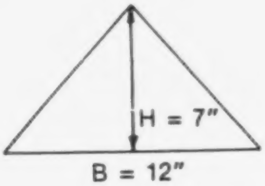
$A = \Pi r^2$

$= 3.14 \times (5 \times 5)$

= 78.50 square inches

- **triangle** — Use the formula Area = ½ Base × Height, or A = ½ BH

FIGURE 19



$$A = \frac{1}{2}BH$$

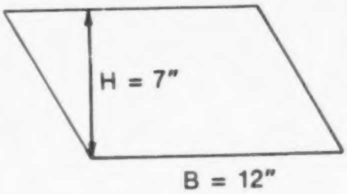
$$= (\frac{1}{2} \times 12) \times 7$$

$$= 6 \times 7$$

= 42 square inches

- **parallelogram** — use the formula Area = Base × Height, of A = BH

FIGURE 20



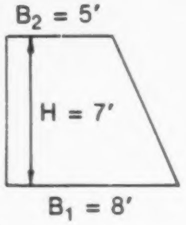
$$A = BH$$

$$= 12 \times 7$$

= 84 square inches

— **trapezoid** — use the formula Area = $\frac{1}{2}H(B_1 + B_2)$

FIGURE 21



$$A = \frac{1}{2}H(B_1 + B_2)$$

$$= (\frac{1}{2} \times 7) \times (8 + 5)$$

$$= \frac{7}{2} \times 13$$

$$= \frac{7}{2} \times \frac{13}{1}$$

$$= \frac{91}{2}$$

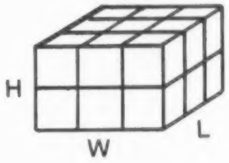
$$= 45\frac{1}{2} \text{ square feet}$$

- Calculating the volume of solid figures

  NOTE: Volume is always measured in cubic units.

  — Using counting method — Use formula Cubic Units = Number of Cubes in Layer × Number of Layers (Figure 22)

FIGURE 22



Cubic Units = Number of Cubes in Layer × Number of Layers

= 9 × 2

= 18 cubes

— Using formula and converting as necessary

1. Using formula Volume = Length × Width × Height or V = LWH

EXAMPLE 1:

Where L = 3 feet, W = $\frac{1}{2}$ foot, and H = $1\frac{1}{2}$ feet

$$V = LWH$$

$$= 3 \times \frac{1}{2} \times 1\frac{1}{2}$$

$$= \frac{9}{4} \text{ or } 2\frac{1}{4} \text{ cubic feet}$$

EXAMPLE 2:

Where L = 10 feet, W = 8 feet, and H = 3 feet

$$V = LWH$$

$$= 10 \times 8 \times 3$$

$$= 240 \text{ cubic feet}$$

OBJECTIVE 8

Given alternatives, correctly respond to cubic yard calculations.

$$\text{Cubic Yards} = \frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27}$$

NOTE: The formula for converting will differ, depending on the units being converted. The formula for cubic yards is given in the example because it is the conversion most often used in construction. Because given measurements are usually in feet and inches, thickness in inches must be broken down by using fractions or decimals.

EXAMPLE 1: Converting to yards, using fractions where width = 30′, length = 60′, and thickness = 4"

$$\text{Cubic Yards} = \frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27}$$

$$= \frac{30' \times 60' \times 4''}{27}$$

$$= \frac{30' \times 60' \times 1/3'}{27}$$

= 22.2 cubic yards

EXAMPLE 2: Converting to yards, using decimals where width = 30′, length = 60′, and thickness = 4"

$$\text{Cubic Yards} = \frac{\text{Width in Feet} \times \text{Length in Feet} \times \text{Thickness in Feet}}{27}$$

$$= \frac{30' \times 60' \times .33'}{27}$$

$$= \frac{594}{27}$$

= 22.2 cubic yards

OBJECTIVE 9 **Solve and select between responses, the correct answers to ratio and proportion problems.**

- Ratio
  - To increase or decrease proportionally, multiply or divide each number in the ratio by the same number.

    NOTE: Ratio indicates parts of material per mix; proportion indicates that the ratio is the same but the quantity may differ.

EXAMPLE 1: You want to find half of the ratio 1:1:3.

Divide each number in the ratio by 2 to get 0.5:0.5:1.5

EXAMPLE 2: You need three times the ratio 1:1:3.

Multiply each number in the ratio by 3 to get 3:3:9.

Fractional and Decimal Equivalents

0.0 0 0 0

FRACTION		DECIMAL	WORD
1/4	=	0.25	= Twenty-five hundreds
1/2	=	0.5	= Five tens
7/8	=	0.875	= Eight hundred seventy-five thousandths.
7/16	=	0.4375	= Four hundred thirty-seven thousandths and five ten-thousandths.

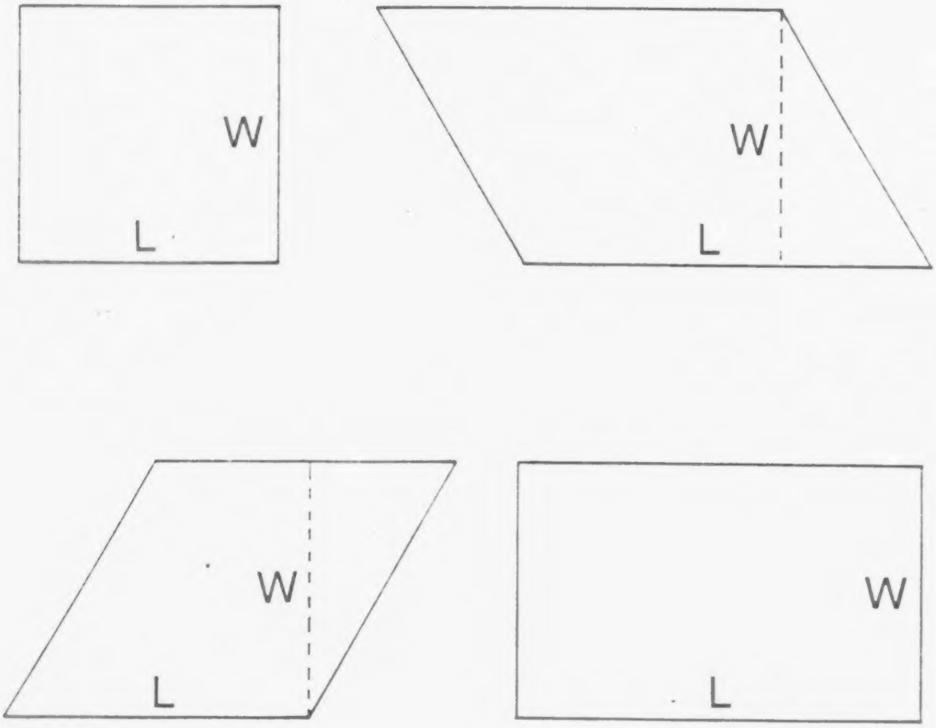
Decimal Equivalent Chart To One Inch

1/64	.015625
1/32	.03125
3/64	.0468752
1/16	.0625
5/64	.078125
3/32	.09375
7/64	.109375
1/8	.125
9/64	.140625
5/32	.15625
11/64	.171875
3/16	.1875
13/64	.203125
7/32	.21875
15/64	.234375
2/8	.25
17/64	.265625
9/32	.28125
19/64	.296875
5/16	.3125
21/64	.328125
11/32	.34375
23/64	.359375
3/8	.375
25/64	.390625
13/32	.40625
27/64	.421875
7/16	.4375
29/64	.453125
15/32	.46875
31/64	.484375
1/2	.5
33/64	.515625
17/32	.53125
35/64	.546875
9/16	.5625
37/64	.578125
19/32	.59375
39/64	.609375
5/8	**.625**
41/64	.640625
21/32	.65625
43/64	.671875
11/16	.6875
45/64	.703125
23/32	.71875
47/64	.734375
3/4	.75
49/64	.765625
25/32	.78125
51/64	.796875
13/16	.8125
53/64	.828125
27/32	.84375
55/64	.859375
7/8	**.875**
57/64	.890625
29/32	.90625
59/64	.921875
15/16	.9375
61/64	.953125
31/32	.96875
63/64	.984375
8/8	**1.**

Decimals of Fractional Inches to One Foot

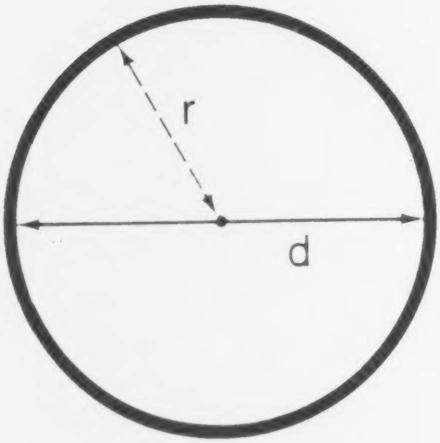
Inch	0″	1″	2″	3″	4″	5″	6″	7″	8″	9″	10″	11″
0	.0000	.0833	.1677	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167
1/16	.0052	.0885	.1719	.2552	.3385	.4219	.5052	.5885	.6719	.7552	.8385	.9219
1/8	.0104	.0937	.1771	.2604	.3437	.4271	.5104	.5937	.6771	.7604	.8437	.9271
3/16	.0156	.0990	.1823	.2656	.3490	.4323	.5156	.5990	.6823	.7656	.8490	.9323
1/4	.0208	.1042	.1875	.2708	.3542	.4375	.5208	.6042	.6875	.7708	.8542	.9375
5/16	.0260	.1094	.1927	.2760	.3594	.4427	.5260	.6094	.6927	.7760	.8594	.9427
3/8	.0312	.1146	.1979	.2812	.3646	.4479	.5312	.6146	.6979	.7812	.8646	.9479
7/16	.0365	.1198	.2031	.2865	.3698	.4531	.5365	.6198	.7031	.7865	.8698	.9531
1/2	.0417	.1250	.2083	.2917	.3750	.4583	.5417	.6250	.7083	.7917	.8750	.9583
9/16	.0469	.1302	.2135	.2969	.3802	.4635	.5469	.6302	.7135	.7969	.8802	.9635
5/8	.0521	.1354	.2188	.3021	.3854	.4688	.5521	.6354	.7188	.8021	.8854	.9688
11/16	.0573	.1406	.2240	.3073	.3906	.4740	.5573	.6406	.7240	.8073	.8906	.9740
3/4	.0625	.1458	.2292	.3125	.3958	.4792	.5625	.6458	.7292	.8125	.8958	.9792
13/16	.0677	.1510	.2344	.3177	.4010	.4844	.5677	.6510	.7344	.8177	.9010	.9844
7/8	.0729	.1562	.2396	.3229	.4062	.4896	.5729	.6562	.7396	.8229	.9062	.9896
15/16	.0781	.1615	.2448	.3281	.4115	.4948	.5781	.6615	.7448	.8281	.9115	.9948

Area of a Parallelogram



Area = Length (L) × Width (W)

Properties of a Circle



Pi (Π) = 3.1416

Radius (r) = $\frac{\text{Diameter (d)}}{2}$

Area of Circle $= \Pi r^2$

Circumference $= 2\Pi r$

Ratio and Proportion

EXAMPLES:

one batch = 1:1:3 = Ratio of Cement.
= Lime, and Sand
in Mortar Mix

1/2 batch = 0.5:0.5:1.5 = Proportion of Ratio
1:1:3 Cut in Half

2 batches = 2:2:6 Double Ratio

Name ______________________________ Score __________

OBJECTIVE 3

Select from a list of correct alternatives, solutions to whole number problems.

INTRODUCTION

The following exercises will form part of your math background and serve as a basis for completing other exercises and problems.

INSTRUCTIONS

Solve each of the following whole number problems.

Operation and Calculation Skills
- Calculate with whole numbers

Math Application Skills
- Solve word problems

Part 1 — Adding whole numbers

_____ 1. If a carpenter used 330 lineal feet of two-by-four on one wall, 570 lineal feet on another, and 275 on another, how many lineal feet were used?

a. 605
b. 845
c. 1,175
d. 1,275

_____ 2. A contractor ordered the following number of doors at different dates: 256, 62, 575, and 242. How many doors should she be billed for?

a. 1,135
b. 1,235
c. 1,335
d. 1,435

_____ 3. If a contractor paid $480 for doors, $13 for trim, $81 for hardware, and $35 for shelving, what was the total cost of the materials?

a. $493
b. $574
c. $600
d. $609

_____ 4. If it takes 1,135 square feet of flooring for the first apartment, 1,225 square feet for the second, 1,220 square feet for the third, 1,125 square feet for the fourth, and 7,425 square feet for the last apartment, what would be the total square feet of flooring needed?

a. 12,132
b. 12,131
c. 12,130
d. 12,129

Part 2 — Subtracting whole numbers

_____ 1. If a wall takes 172 studs and you have 46, how many more studs would you need for the job?

a. 116
b. 126
c. 136
d. 218

_____ 2. If you have 542 square feet of insulation and it takes 1, 702 square feet of insulation to complete the job, how many more square feet will you need?

a. 542
b. 1,160
c. 1,560
d. 2,244

_____ 3. You have 6,520 square feet of roofing to replace on a remodeling job. You have 470 square feet left over from another job and 1,650 square feet in your warehouse. How many more square feet will you need to complete the job?

a. 2,100
b. 3,400
c. 3,900
d. 4,400

_____ 4. A carpenter ordered 48,000 wall studs. Of these, he used 4,850 on one job, 12,720 on another job, and 16,285 on another job. How many studs did he have left?

a. 14,145
b. 16,285
c. 48,000
d. 60,720

Part 3 — Multiplying whole numbers

_____ 1. If one load of top soil weighs 9,769 pounds, how many pounds would 7 loads weigh?

a. 9,769
b. 9,776
c. 68,383
d. 69,383

_____ 2. If a carpenter can nail an average of 170 square feet of siding per hour, how many square feet can she nail in 48 hours?

a. 48
b. 170
c. 218
d. 8,160

______ 3. Six roofers lay an average of 950 square feet of roofing per person per day. What will be their average square feet per person for 3 days' work?

a. 953
b. 2,850
c. 3,650
d. 4,027

______ 4. Figure the number of hours worked in 4 weeks by 12 welders who work 30 hours each week.

a. 1,440
b. 1,360
c. 1,210
d. 120

Part 4 — Dividing whole numbers

______ 1. Four roofers working together laid 8,280 square feet of roofing in one day. What was the average number of square feet laid by each roofer that day?

a. 8,280
b. 4,140
c. 3,000
d. 2,070

______ 2. A home buyer has requested that one wall of a dining room be done in 1-foot-by-4-foot windows. How many windows can be installed if the wall is 108 inches long and the windows, with connecting mulls, are 13 inches wide? How much space will be left?

a. 4 windows, 4 inches
b. 6 windows, 8 inches
c. 8 windows, 8 inches
d. 8 windows, 4 inches

_____ 3. A contractor built 26 houses in an addition. The project required 2,535 board feet of white pine. How much white pine was required on the average per house?

a. 97½
b. 90
c. 67½
d. 9¾

_____ 4. A sheet of 4-foot-by-8-foot plywood is 32 square feet. How many sheets of plywood would be required to deck a roof area of 2,176 square feet if no allowance is made for waste?

a. 32
b. 48
c. 68
d. 88

ASSIGNMENT SHEET 2

APPLIED CONSTRUCTION MATH

B 2

Name ________________________________ Score __________

OBJECTIVE 4

Given choices, pick the correct alternatives to fractional problems.

INTRODUCTION

The following assignment sheet allows you to practice your skills in solving word problems dealing with fractions.

INSTRUCTIONS

Operation and Calculation Skills
- Calculate with fractions

Solve each of the following problems dealing with fractions.

Part 1 — Reducing fractions to their lowest terms

_____ 1. The lowest term for $4/8$ is

a. $2/4$
b. $1/2$
c. $8/32$
d. $32/64$

_____ 2. The lowest term for $8/16$ is

a. $4/16$
b. $8/32$
c. $16/32$
d. $1/2$

_____ 3. The lowest term for $2/2$ is

a. 1
b. 2
c. 3
d. 4

_____ 4. The lowest term for $12/16$ is

a. $4/3$
b. $3/8$
c. $3/4$
d. 1

Part 2 — Converting fractions to equivalent denominations

_____ 1. The fraction $\frac{1}{2}$ is equivalent to

a. $\frac{1}{8}$
b. $\frac{2}{8}$
c. $\frac{3}{8}$
d. $\frac{4}{8}$

_____ 2. The fraction $\frac{1}{4}$ is equivalent to

a. $\frac{4}{32}$
b. $\frac{6}{32}$
c. $\frac{7}{32}$
d. $\frac{8}{32}$

_____ 3. The fraction $\frac{9}{16}$ is equivalent to

a. $\frac{10}{32}$
b. $\frac{12}{32}$
c. $\frac{18}{32}$
d. $\frac{32}{32}$

_____ 4. The fraction $\frac{28}{64}$ is equivalent to

a. $\frac{6}{16}$
b. $\frac{7}{16}$
c. $\frac{8}{16}$
d. $\frac{9}{16}$

Part 3 — Adding fractions

_____ 1. The sum of $\frac{1}{2} + \frac{2}{8}$ is

a. $\frac{3}{4}$
b. $\frac{20}{32}$
c. $\frac{7}{8}$
d. $\frac{3}{12}$

_____ 2. The sum of $\frac{4}{16} + \frac{3}{4}$ is

a. $1\frac{1}{4}$
b. 1
c. $\frac{3}{4}$
d. $\frac{7}{20}$

______ 3. The sum of $\frac{5}{8} + \frac{3}{32}$ is

a. $\frac{23}{32}$
b. $\frac{32}{32}$
c. $\frac{7}{8}$
d. $\frac{8}{40}$

______ 4. The sum of $\frac{9}{16} + \frac{5}{8}$ is

a. $\frac{11}{16}$
b. $\frac{18}{16}$
c. $\frac{14}{24}$
d. $1\frac{3}{16}$

Part 4 — Subtracting fractions

______ 1. The difference of $\frac{3}{4} - \frac{3}{16}$ is

a. $\frac{7}{16}$
b. $\frac{8}{16}$
c. $\frac{9}{16}$
d. $\frac{10}{16}$

______ 2. The difference of $\frac{7}{8} - \frac{1}{4}$ is

a. $\frac{4}{8}$
b. $\frac{5}{8}$
c. $\frac{6}{8}$
d. $\frac{8}{8}$

______ 3. The difference of $\frac{30}{32} - \frac{3}{4}$ is

a. $\frac{1}{16}$
b. $\frac{2}{16}$
c. $\frac{3}{16}$
d. $\frac{4}{16}$

______ 4. The difference of $\frac{25}{32} - \frac{5}{8}$ is

a. $\frac{5}{32}$
b. $\frac{6}{32}$
c. $\frac{7}{32}$
d. $\frac{8}{32}$

Part 5 — Multiplying fractions

_____ 1. A porch roof slopes in such a way that the roof is ¼ foot higher for each horizontal foot along the base of the roof. What is the total rise if the porch roof rises for a distance of 8½ feet?

a. 1⅛
b. 1½
c. 2
d. 2⅛

_____ 2. A certain adhesive requires mixing ¾ gallon base and ¼ gallon hardener to make a gallon of adhesive. How much base should a worker use if she needs to mix only ⅓ gallon of adhesive?

a. 1/16
b. ⅛
c. ¼
d. ½

_____ 3. There are 296 four-penny nails per pound. How many nails are there in ¼ pound?

a. 70
b. 72
c. 74
d. 76

_____ 4. After completing an addition of houses, a contractor has 8⅔ squares of shingles left in three different colors. If one-half of the shingles are brown-blend, how many squares of brown-blend shingles are there?

a. 4⅓
b. 5⅓
c. 6⅓
d. 7⅓

ASSIGNMENT SHEET 3

APPLIED CONSTRUCTION MATH B 2

Name ______________________________ Score __________

OBJECTIVE 5

Solve and select correct answers to decimal problems.

INTRODUCTION

As a consumer of raw materials, a construction worker often needs to calculate the costs of building a structure. Such costs are figured in dollars and cents. But cents are only decimal parts of a dollar, and every time you total the cost of a purchase, you are adding decimals.

You can add decimals just as you add whole numbers. You must be careful, though, to keep all decimal points aligned.

INSTRUCTIONS

Operation and Calculation Skills
- Calculate with decimals

Math Application Skills
- Solve word problems

Functional Math Skills
- Solve practical problems

Solve the following decimal problems.

Part 1 — Adding decimals

_____ 1. A contractor bought some roofing materials and spent $141.72 for shingles, $16.81 for felt paper, and $6.27 for flashing. What was the total cost of the roofing materials?

a. $132.80
b. $164.80
c. $174.80
d. $264.80

_____ 2. An electrician worked four days for a certain contractor. She worked 6.8 hours Monday, 7.4 hours Tuesday, 9.3 hours Wednesday, and 4.4 hours Thursday. How many total hours did she work for the contractor?

a. 20.9
b. 23.1
c. 25.9
d. 27.9

_____ 3. How much was spent on tools if a carpenter bought the tools below at the prices listed?

Circular saw	$95.88
Hand saw	$9.95
Drill bit	$.39
Hammer	$6.49
Hammer	$10.00

a. $122.71
b. $123.71
c. $162.91
d. $171.22

Part 2 — Subtracting decimals

_____ 1. A project manager keeps track of mileage driven on the job. At the beginning of the month, the vehicle odometer reads 29,268.4. At the end of the month, the odometer reads 29,872.1. How many miles were driven during the month?

a. 603.7
b. 604.7
c. 605.7
d. 606.7

_____ 2. An equipment operator completed an excavation project and computed his profit. He was paid $6,500.00 for the project. How much profit did he make if his expenses were $4,718.96?

a. $6,500.00
b. $4,178.96
c. $1,781.04
d. $11,281.96

_____ 3. A carpenter has been using 12-gauge and 14-gauge flashing. In order to determine which screws to use to install skylights, she must know the difference in thickness of the two gauges. What is the difference if 12-gauge is 0.080-inch thick and 14-gauge is 0.0641-inch thick?

a. .0167
b. .0163
c. .0159
d. .1449

_____ 4. A purchasing agent bought plywood on sale. He had estimated the cost to be $1,238.62 based on the regular price. How much did he save if the cost on sale was $1,061.19?

a. $176.43
b. $177.43
c. $178.43
d. $198.43

_____ 5. A floor plan has 1,781 square feet of living space. A change is made to the plan, reducing the living space by 264.5 square feet. What is the area of the modified plan?

a. 1,416.5
b. 1,506.5
c. 1,510.4
d. 1,516.5

Part 3 — Multiplying decimals

_____ 1. A radial arm saw is placed on sale for 25 percent off. How much is the price reduced if the regular price is $1,349.80?

a. $263.45
b. $327.45
c. $335.62
d. $337.45

_____ 2. The average cost per square foot of houses in a certain area is $41.25. What would be the approximate cost of a 1500-square-foot house?

a. $61,875.00
b. $62,855.00
c. $73,875.00
d. $76,275.00

_____ 3. A building code specifies a maximum grade for lawns of 33.3 percent, which means that the maximum slope for a lawn 100 feet in length would be 33.3 feet. How much slope would be allowed for a lot 75 feet deep?

a. 22.97 feet
b. 24.98 feet
c. 26.96 feet
d. 28.95 feet

_____ 4. A welder buys 38 steel bars at a cost of $3.49 each. What is the total cost?

a. $122.62
b. $128.79
c. $132.59
d. $132.62

_____ 5. If the average weight of composition shingles is 2.5 pounds per square foot, what is the total weight of the composition roofing on a 831.75 square foot area?

a. 2,049.88
b. 2,059.38
c. 2,079.38
d. 2,079.88

Part 4 — Dividing decimals

______ 1. What is the approximate cost per sheet of plywood if the cost of twelve sheets is $103.68?

a. $7.64
b. $8.64
c. $9.83
d. $11.47

______ 2. How many hours did a carpenter work if she was paid a total of $681.75 at the rate of $22.50 per hour?

a. 20.3
b. 26.8
c. 30.3
d. 34.3

______ 3. How many lots can be plotted on a 21.12-acre addition if the average lot is .66 acres?

a. 16
b. 24
c. 32
d. 64

______ 4. A carpenter spent $172.80 for doors. What was the cost per door if he bought eight doors?

a. $21.60
b. $22.60
c. $32.60
d. $172.80

______ 5. If it takes a roofer 12.6 hours to lay a 1,680 square-foot roof, how many square feet can be completed in one hour?

a. 163.3
b. 153.3
c. 143.3
d. 133.3

ASSIGNMENT SHEET 4

APPLIED CONSTRUCTION MATH

B 2

Name ______________________________ Score ________

OBJECTIVE 6

Provided with a list of alternatives, differentiate between correct and incorrect responses to percentage problems.

INTRODUCTION

In the construction industry, you will frequently come across percentages. Interest rates, pricing discounts, waste allowances, the rise or decline of housing starts, and many other factors that affect the industry are stated as percentages. To make the most of your career in this field, you must understand what percentages mean and how they are used.

INSTRUCTIONS

Math Application Skills
- Solve percent problems

Functional Math Skills
- Solve practical problems

Solve the following percentage problems.

Part 1

_____ 1. What does it mean to say 100 percent of the work is completed?

a. The job is half done.
b. All work is complete.
c. We're almost done.
d. Two-thirds of the work is done.

_____ 2. There are usually 100 tools in the tool shed; fourteen of them are missing. What percent of the tools are missing?

a. 86%
b. 74%
c. 34%
d. 14%

______ 3. If 14 of the tools are missing in the above problem, what percent are present?

a. 14%
b. 34%
c. 86%
d. 100%

______ 4. There are 100 studs in a stack. Twenty-five studs are what percent of the studs in the stack?

a. 25%
b. 50%
c. 75%
d. 100%

______ 5. There are 100 jobs on the agenda. Ninety-four have been completed. What percent of the jobs have been completed?

a. 94%
b. 84%
c. 32%
d. 6%

______ 6. If 94 of the jobs in the above problem have been completed, how many have not been?

a. 94%
b. 84%
c. 16%
d. 6%

______ 7. If 11 percent of the students in a school are absent, what percent are present?

a. 11%
b. 74%
c. 88%
d. 89%

_____ 8. If 6 percent of the hand saws that a store had in stock were not sold, what percent were sold?

a. 100%
b. 94%
c. 86%
d. 6%

_____ 9. If 60 percent of the carpenters in town had cards, what percent did not have cards?

a. 60%
b. 50%
c. 40%
d. 30%

_____10. Bill has a set of carpentry tools. Ten percent of his tools are a year old, and 40 percent are over a year old. What percent are less than a year old?

a. 40%
b. 50%
c. 60%
d. 70%

_____11. Susan has three types of screwdrivers — flat, Phillips, and square. Eighty percent of her screwdrivers are flat, and 15 percent are square. What percent are Phillips?

a. 15%
b. 10%
c. 5%
d. None

_____12. The Smiths spent 22 percent of their income for their business, 17 percent for tools, 15 percent for work clothes, and 8 percent for entertainment. What percent was left for other things?

a. 62%
b. 56%
c. 32%
d. 38%

______13. Chester has finished 75 percent of the job he is doing. What percent does he still have to do?

a. 100%
b. 75%
c. 50%
d. 25%

______14. Betty has completed 40 percent of her training. What percent does she still have to do?

a. 60%
b. 50%
c. 40%
d. 30%

______15. If you were told to complete 93 percent of the work, what percent would be left?

a. 2%
b. 7%
c. 23%
d. 93%

Part 2

______ 1. There are 20 students in a class. Sixty percent of the students are boys. How many are boys?

a. 8
b. 10
c. 12
d. 16

______ 2. One day 5 percent of the 20 carpenters in Mr. Moore's group made perfect time completing a job. How many carpenters made perfect time?

a. 1
b. 2
c. 3
d. 19

_____ 3. A plumber bought a new pipe threader, regularly selling for $120, at a sale and saved 20 percent. How much money did he save?

a. $2.40
b. $24.00
c. $48.00
d. $96.00

_____ 4. The number of electricians at the meeting this week was 75 percent of what it was last week. Last week there were 800 attending. How many electricians were at the meeting this week?

a. 800
b. 600
c. 400
d. 200

ASSIGNMENT SHEET 5

APPLIED CONSTRUCTION MATH

B 2

Name ______________________________ Score __________

OBJECTIVE 7

Make a selection between alternatives, the correct answers to geometric problems.

INTRODUCTION

One of the most common mathematical operations in estimating materials is the calculation of area. You must figure area on roofs for shingles, on walls and ceilings for drywall and other coverings, in attics and walls for insulation, on floors for flooring and floor coverings, on exterior walls for finishing materials, and in many other areas of construction. In fact, the basic pricing unit in the industry is figured on the area of a structure. Therefore, to understand the costs of materials and construction, you must learn to calculate area.

INSTRUCTIONS

Calculate the area of the following geometric figures.

Operation and Calculation Skills
- Calculate with whole numbers

Math Application Skills
- Use English and metric measures
- Apply geometry principles

Part 1 — Squares

_____ 1. A square with eight inch sides has an area of _____ square inches.

a. 8
b. 32
c. 64
d. 128

_____ 2. A square with sixteen foot sides has an area of _____ square feet.

a. 128
b. 256
c. 512
d. 1,024

Part 2 — Rectangles

_____ 1. What is the area of a rectangle that has a L = 12′ and a W = 5′?

a. 17 square feet
b. 30 square feet
c. 45 square feet
d. 60 square feet

_____ 2. What is the area of a rectangle measuring L = 24 yd. and W = 8 yd.?

a. 32 square yards
b. 192 square yards
c. 224 square yards
d. Unknown with the data provided

_____ 3. The area of a 17″ × 31″ rectangle is _____ square inches.

a. 527
b. 316
c. 150
d. 48

_____ 4. The area of a 16′ × 62′ rectangle is _____ square feet.

a. 48
b. 96
c. 556
d. 992

Part 3 — Circles

_____ 1. The area of a circle with a 6″ radius is _____ square inches.

a. 116.04
b. 115.64
c. 113.04
d. 117.51

_____ 2. The area of a circle with a 16 yd. radius is _____ square yards.

a. 101.15
b. 256.00
c. 561.84
d. 803.84

_____ 3. The area of a circle with a 11.3′ radius is _____ square feet.

a. 400.95
b. 400.19
c. 362.21
d. 35.48

_____ 4. The area of a circle with a 12″ radius is _____ square inches.

a. 640.27
b. 452.16
c. 452.00
d. 37.68

Part 4 — Triangles

_____ 1. What is the area of a triangle with a base of 8″ and a height of 12″?

a. 48 square inches
b. 50 square inches
c. 52 square inches
d. 54 square inches

_____ 2. The area of a triangle with a base of 21′ and a height of 19′ is _____ square feet.

a. 197.5
b. 198.5
c. 199.5
d. 200.6

Part 5 — Parallelograms

_____ 1. A parallelogram with a base of 16″ and a height of 16″ has an area of _____ square inches.

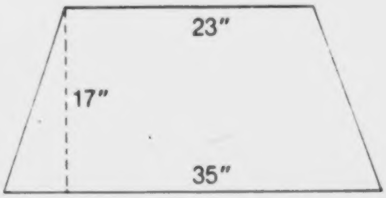
a. 32
b. 64
c. 128
d. 256

_____ 2. What is the area of a parallelogram measuring 27 yards at the base and 9 yards in height?

a. 240 square yards
b. 243 square yards
c. 245 square yards
d. 247 square yards

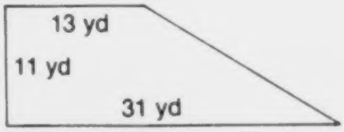
Part 6 — Trapezoids

_____ 1. What is the area of the trapezoid shown below?



a. 493 square inches
b. 495 square inches
c. 497 square inches
d. 499 square inches

_____ 2. With the trapezoid measurements below, what is the area?



a. 238 square yards
b. 240 square yards
c. 242 square yards
d. 244 square yards

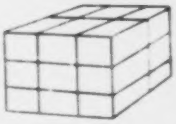
Part 7 — Calculate the volume of solid figures.

INSTRUCTIONS

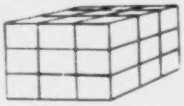
Record the dimensions and volume for the figures on the following page. Remember that volume is the number of cubic units.

	Height = H	Width = W	Length = L	Volume = V
1.				
2.				
3.				
4.				
5.				
6.				
7.				
8.				
9.				
10.				

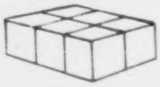
1.



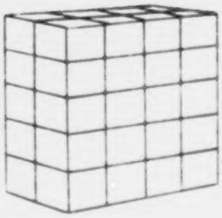
2.



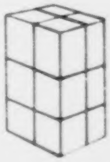
3.



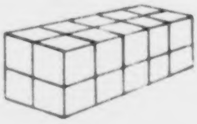
4.



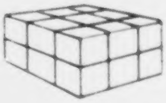
5.



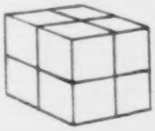
6.



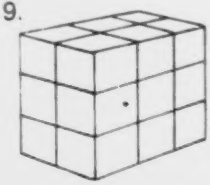
7.



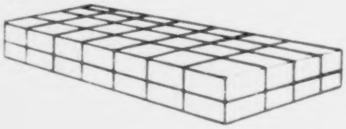
8.



9.

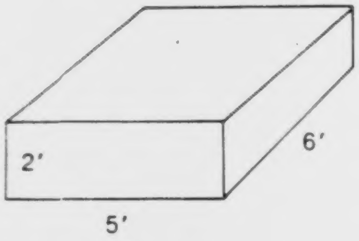


10.



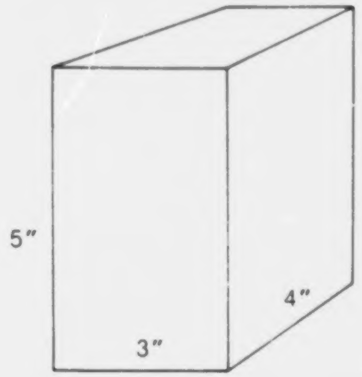
Calculate volume for the following figures.

_____11. What is the volume for the figure below?



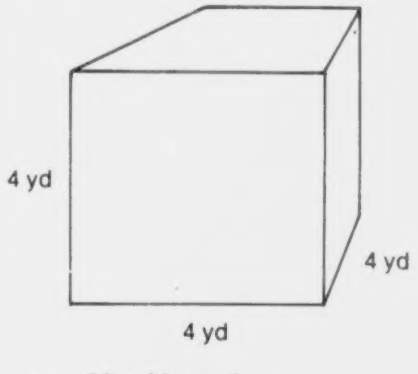
a. 60 cubic feet
b. 70 cubic feet
c. 80 cubic feet
d. 90 cubic feet

_____12. What is the volume for the figure below?



a. 40 cubic inches
b. 50 cubic inches
c. 60 cubic inches
d. 70 cubic inches

_____13. With the dimensions shown, what is the volume of the figure below?



a. 62 cubic yards
b. 64 cubic yards
c. 66 cubic yards
d. 68 cubic yards

ASSIGNMENT SHEET 6

APPLIED CONSTRUCTION MATH

B 2

Name ______________________ Score ________

OBJECTIVE 8

Given alternatives, correctly respond to cubic yard calculations.

INTRODUCTION

Construction workers often have to compute cubic yard measurements to estimate materials and labor. Cubic yard is the basic unit of measurement for excavation and fill dirt, for concrete, for mortars and grouts, and for other materials. Therefore, a construction worker must be able to calculate cubic yard measurements accurately.

INSTRUCTIONS

Solve the following problems involving cubic yards.

_____ 1. How many cubic yards of concrete will it take for a driveway 20 feet wide by 72 feet long by 4 inches thick?

a. 19.1 cubic yards
b. 18.6 cubic yards
c. 17.8 cubic yards
d. 15.6 cubic yards

_____ 2. Find the total cubic yards of insulation it will take to fill a cavity wall if the cavity is 8 feet high, 22 feet long, and 6 inches thick.

a. 3.3 cubic yards
b. 4.2 cubic yards
c. 4.6 cubic yards
d. 5.2 cubic yards

Operation and Calculation Skills
- Estimate answers
- Calculate with whole numbers

Math Application Skills
- Solve word problems
- Select/apply mathematical formula
- Use English and metric measures
- Apply geometry principles

_____ 3. How many cubic yards of grout will it take to fill a cavity 12 feet high, 37 feet long, and 3 inches thick?

a. 3.9 cubic yards
b. 4.1 cubic yards
c. 4.3 cubic yards
d. 4.7 cubic yards

_____ 4. Find the total cubic yards of sand it will take to provide 4 inches of fill in a swimming pool 34 feet wide and 45 feet long.

a. 16.8 cubic yards
b. 18.2 cubic yards
c. 18.4 cubic yards
d. 18.9 cubic yards

_____ 5. How many cubic yards of concrete will it take to pour a sidewalk 6 feet wide, 188 feet long, and 4 inches thick?

a. 10.9 cubic yards
b. 11.9 cubic yards
c. 12.9 cubic yards
d. 13.9 cubic yards

ASSIGNMENT SHEET 7

APPLIED CONSTRUCTION MATH

B 2

Name ______________________________ Score __________

OBJECTIVE 9

Solve and select between responses, the correct answers to ratio and proportion problems.

INTRODUCTION

The construction trade uses more ratios and proportions today than ever before. New plastics and adhesives often require mixing. Additionally, mortars and other materials require mixing. Ratios are used to designate grade slopes and relationships such as heat loss and load-bearing capacities. The construction worker will be required to calculate some ratios and proportions and will be required to apply many others.

INSTRUCTIONS

Solve the following ratio and proportion problems.

_____ 1. Convert the ratio 0.25:0.25:1 to the smallest proportion possible containing whole numbers.

a. 1:1:1
b. 1:1:4
c. 2:2:2
d. 3:2:2

_____ 2. What would be the proportion if a 1:2:12 mix were cut in half?

a. 1:1:6
b. 2:4:24
c. 0.5:1:6
d. 0.5:1:12

Operation and Calculation Skills
- Calculate with decimals
- Convert whole numbers to decimals

Math Application Skills
- Solve word problems
- Solve ratio/ proportion problems

Functional Math Skills
- Solve practical problems

______ 3. What would be the proportion if the ratio 1:1:3 were tripled?

a. 3:3:9
b. 3:3:3
c. 2:3:9
d. 2:1:9

______ 4. You are asked to mix a batch of mortar using a 1:1:6 ratio, but you will need six times this amount. What will be the proportion of material needed?

a. 6:6:12
b. 6:3:18
c. 6:18:36
d. 6:6:36

ASSIGNMENT SHEET 1

Part 1 — Adding whole numbers

1. c
2. a
3. d
4. c

Part 2— Subtracting whole numbers

1. b
2. b
3. d
4. a

Part 3 — Multiplying whole numbers

1. c
2. d
3. b
4. a

Part 4 — Dividing whole numbers

1. d
2. d
3. a
4. c

ASSIGNMENT SHEET 2

Part 1 — Reducing fractions to their lowest terms

1. b
2. d
3. a
4. c

Part 2 — Converting fractions to their equivalent denominations

1. d
2. d
3. c
4. b

Part 3 — Adding fractions

1. a
2. b
3. a
4. d

Part 4 — Subtracting fractions

1. c
2. b
3. c
4. a

Part 5 — Multiplying fractions

1. d
2. c
3. c
4. a

ASSIGNMENT SHEET 3

Part 1 — Adding decimals

1. b
2. d
3. a

Part 2 — Subtracting decimals

1. a
2. c
3. c
4. b
5. d

Part 3 — Multiplying decimals

1. d
2. a
3. b
4. d
5. c

Part 4 — Dividing decimals

1. b
2. c
3. c
4. a
5. d

ASSIGNMENT SHEET 4

Part 1

1. b
2. d
3. c
4. a
5. a
6. d
7. d
8. b
9. c
10. b
11. c
12. d
13. d
14. a
15. b

Part 2

1. c
2. a
3. b
4. b

ASSIGNMENT SHEET 5

Part 1 — Squares

1. c
2. b

Part 2 — Rectangles

1. d
2. b
3. a
4. d

Part 3 — Circles

1. c
2. d
3. a
4. b

Part 4 — Triangles

1. a
2. c

Part 5 — Parallelograms

1. d
2. b

Part 6 — Trapezoids

1. a
2. c

ASSIGNMENT SHEET 5

Part 7 — Calculate the volume of solid figures.

NOTE: Answers may be reversed in the width and length columns.

	Height = H	Width = W	Length = L	Volume = V
1.	3	3	2	18
2.	3	3	3	27
3.	2	3	3	18
4.	3	2	2	12
5.	2	2	5	20
6.	3	2	3	18
7.	5	2	4	40
8.	1	2	3	6
9.	2	2	2	8
10.	2	4	7	56

11. a
12. c
13. b

ASSIGNMENT SHEET 6

1. c
2. a
3. b
4. d
5. d

ASSIGNMENT SHEET 7

1. b
2. c
3. a
4. d

WRITTEN TEST

APPLIED CONSTRUCTION MATH

B 2

Name ______________________________ Score __________

OBJECTIVE 1

Given a list of math terms, match them to their correct definitions.

_____ 1. To perform a mathematical operation is to

a. symbolize
b. modulate
c. direct
d. calculate

_____ 2. The process of totaling two or more numbers to find another number is called

a. addition
b. subtraction
c. multiplication
d. ratio

_____ 3. Which of the following terms represents the opposite operation of multiplication?

a. Addition
b. Subtraction
c. Calculating
d. Division

_____ 4. Which of the following terms represents the relationship in quantity, amount, or size between two or more things?

a. Percent
b. Nominal
c. Ratio
d. Caret

May be photocopied for student use.

_____ 5. Which of the following definitions best matches the term "fraction"?

a. Ratio to the number one
b. Part of a whole represented by one or more equal parts
c. PI of a circle
d. Percentage of a value expressed in numbers

_____ 6. Any of the natural numbers that represents a complete item is called a

a. fraction
b. whole number
c. ratio item
d. percent

_____ 7. The caret is an inverted "v" used to:

a. indicate where something is to be inserted
b. mark a math equation as a division
c. place a paragraph break in a document
d. mark where a deletion is to be performed

OBJECTIVE 2

Choose the appropriate name for a given mathematical symbol.

_____ 1. The mathematical symbol ":" represents a _______________ operation.

a. equal
b. PI sign
c. percent
d. ratio

_____ 2. The symbol "÷" represents which of the following mathematical operations?

a. Multiplication
b. Caret
c. Division
d. Ratio

May be photocopied for student use

_____ 3. Which of the following terms matches the mathematical symbol of "%"?

a. Percent
b. Value replaced by
c. Ratio
d. Caret

NOTE: Objectives 3-9 are evaluated on assignment sheets in this unit. If you have not completed these components, see your instructor.

May be photocopied for student use.

OBJECTIVE 1

1. d
2. a
3. d
4. c
5. b
6. b
7. a

OBJECTIVE 2

1. d
2. c
3. a

OBJECTIVE SHEET

MEASURING — *C 1*

INTRODUCTION

Measuring is one of the first basic skills that a construction worker must master. Accurate measurements are very important. if you are to become a construction worker, you must learn to use the correct tools and use them properly. When doing layout work there is no such thing as "good enough" or "close enough;" measurements must be accurate.

UNIT OBJECTIVE

After completing this unit, the student will be able to read rules and accurately measure objects. The student will show this knowledge by completing assignment sheets, job sheet, and unit test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to:

1. Given a list of terms associated with measuring, match them to their correct definitions.
2. Provided a picture, choose the appropriate name for a measuring tool.
3. Select from a list of alternatives, solutions to common errors in making measurements.
4. Calculate the correct responses to problems by reading a rule. (Assignment Sheet 1)
5. Solve problems by reading an engineer's rule. (Assignment Sheet 2)
6. Compute responses to problems by reading a tape. (Assignment Sheet 3)

MEASURING

PREPARATION

- Review unit and plan presentation.
- Modify time frames to suit class needs and plan activities for each class period.
- Obtain materials to supplement unit.

  EXAMPLES: Carpenter's rules, engineer's rules, and tapes for each class member.

  - Several pieces of lumber or metal of different lengths
  - Equipment and supplies needed to perform procedures outlined in assignment and job sheets
- Make transparencies from transparency masters.

DELIVERY

Objective 1: Given a list of terms associated with measuring, match them to their correct definitions.

- Discuss terms associated with measuring.
- Use the chalkboard and actual items to supplement your explanation of each term.

Objective 2: Provided a picture, choose the appropriate name for a measuring tool.

- Discuss basic measuring tools used by construction workers.
- Obtain actual measuring tools and have students identify them.
- Make flash cards containing pictures of the tools. Have students play games using the flash cards.
- Discuss the importance of purchasing and using quality tools.

Objective 3: Select from a list of alternatives, solutions to common errors in making measurements.

- Discuss common errors that contribute to incorrect measurements.
- Encourage students to double-check all measurements and math calculations.

APPLICATION

Objective 4: Calculate the correct responses to problems by reading a rule. (Assignment Sheet 1)

- Provide each student with a rule.
- Use Transparencies 1 and 2 to illustrate graduations on a rule.
- Have students work in teams of two; have one team member point out various graduations on the rule for the other to identify.
- Provide each student with a rule graduated in sixteenths.
- Use Transparencies 4 through 6 to illustrate reading the fourths, eighths, and sixteenths markings on the rule.
- Have students use the rule to measure and record the lengths of several pieces of lumber or metal.
- Have students practice reading a rule to the nearest fraction of an inch by completing Assignment Sheet 1.

Objective 5: Solve problems by reading an engineer's rule. (Assignment Sheet 2)

- Provide each student with an engineer's rule.
- Use Transparency 3 to illustrate graduations on an engineer's rule.
- Have students memorize the three steps in the conversion process outlined in the information sheet. Emphasize how easy this method is and how quickly fractions and inches can be converted once the method is learned.

- Have students review the section on converting fractions in the "Applied Construction Math" unit.

- Have students practice converting fractional inches to hundredths of a foot by completing Assignment Sheet 2.

- Have students work in teams of two; have one team member point out various graduations on the engineer's rule for the other to identify.

- Have students use the engineer's rule to measure and record the lengths of the pieces of lumber or metal. Compare their measurements, and explain the importance of converting from inches to hundredths or from hundredths to inches.

- Have students practice reading an engineer's rule to the nearest hundredth of a foot by completing Assignment Sheet 2.

- Draw lines on poster board or on the floor. Have students practice measuring the lines.

Objective 6: Compute responses to problems by reading a tape. (Assignment Sheet 3)

- Provide each student with a tape.

- Have students use procedures outlined in the information sheet to complete Assignment Sheet 3.

- Have students practice measuring the lengths and widths of the classroom, the shop, the building, and so on.

- Provide a practice exercise in which students have to make general measurements within a specified time.

EVALUATION

Pretest

- Give written test as pretest.

- Determine individual study requirements from pretest results.

- Counsel students individually on pretest results and study requirements.

- Modify materials in unit or create supplementary materials for individual student as required.

Skill Test

- Evaluate students on assignment sheet activities.

- Evaluate students on job sheet activities.

- Complete appropriate section of competency profiles.

- Reteach and reevaluate if necessary.

- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.

- Evaluate students on assignment sheet activities.

  NOTE: The written test may be given in sections if desired.

- Give the written test.

- Reteach and retest if necessary.

- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

UNIT REFERENCES

- McDonnell, Leo P. *Hand Woodworking Tools*. Delmar Publishers: Albany, NY.

- *Stanley Tool Guide*. Stanley Works, Stanley Tools Division, Educational Department: New Britain, CT.

- Willey, Al. *Fundamentals of Carpentry.* Oklahoma Department of Vocational and Technical Education Curriculum and Instructional Materials Center, and the Associated General Contractors of America: Stillwater, OK , 1993.

MEASURING

OBJECTIVE 1

Given a list of terms associated with measuring, match them to their correct definitions.

- **dimension** — numerical notation to denote distance between two points
- **foot** — unit of measure consisting of twelve equal parts called *inches*
- **fraction** — part of a whole; represents one or more equal parts of a unit

  EXAMPLES: ½, ⅜, ¼, 3/16
- **graduations** — marks on a rule or tape indicating measurements

  EXAMPLES: Sixteenths, quarters, halves, inches, and feet; hundredths, tenths, and feet
- **inch** — smallest whole unit of lineal measure commonly used
- **layout** — plan or design of the project to be constructed
- **measuring** — setting of limits or bounds according to a predetermined standard

  NOTE: The standard used in measuring is called a *unit of measurement* or simply a *unit.* Examples of units used to measure distance include inches, feet, meters, and miles.
- **perimeter** — outer limits or boundaries
- **rule** — measuring instrument graduated in whole units and fractions of units

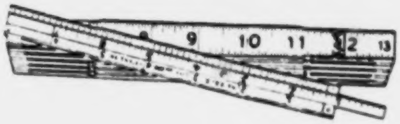
  NOTE: The term *rule* is generally applied to any measuring instrument used to determine distances. One special kind of rule is the *tape*, a steel strip marked in graduations. Tapes can be reeled into a container. In construction, a rule is usually used for measuring distances of a few feet or less and for marking straight lines. A tape is used for measuring distances from a few inches to a hundred feet or more.

- **taut** — tightly stretched; not slack

OBJECTIVE 2 **Provided a picture, choose the appropriate name for a measuring tool.**

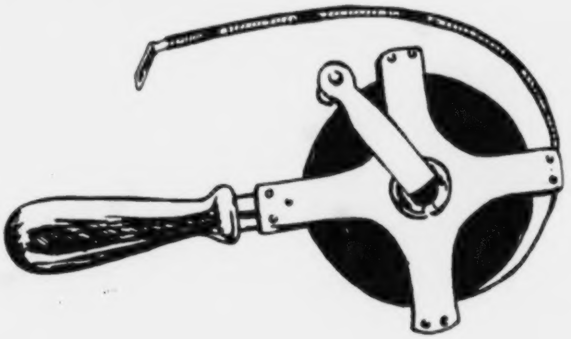
- Folding rule

FIGURE 1



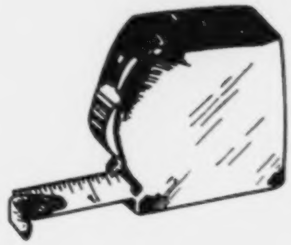
- Surveyor's steel tape (chain)

FIGURE 2



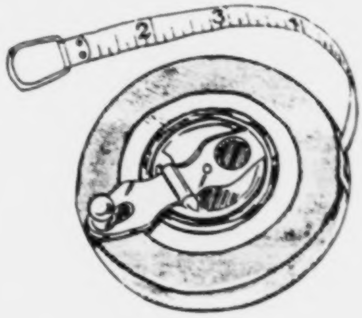
- Retractable steel tape

FIGURE 3



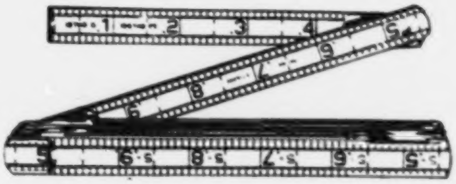
- Steel tape

FIGURE 4



- Engineer's folding rule

FIGURE 5



OBJECTIVE 3 **Select from a list of alternatives, solutions to resolve common errors in making measurements.**

- Removing slack in tape
- Laying tape flat (tape is twisted or kinked)
- Aligning tape or rule properly
- Placing end of tape or rule on reference point
- Reading correct number
- Recording correct number
- Using correct reference point
- Making correct mathematical computations

  EXAMPLE: When converting from one unit of measurement to another

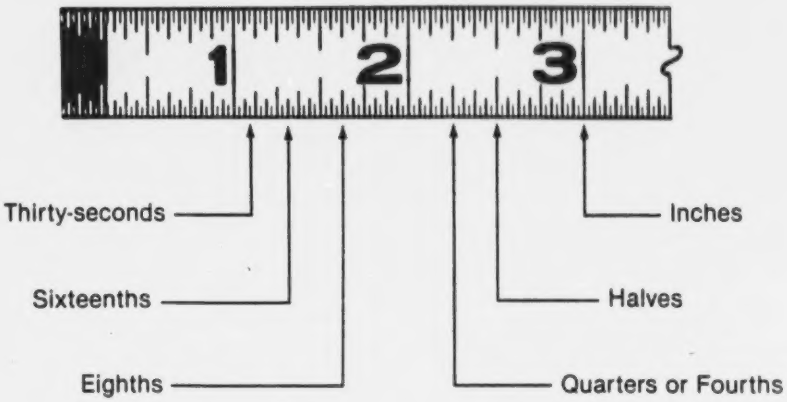
- Using correct measuring tool for job being performed

OBJECTIVE 4 **Calculate the correct responses to problems by reading a ruler.** (Assignment Sheet 1)

- Rule layout

NOTE: Some rules will not have all of the graduations shown in Figure 6.

FIGURE 6



- Sixteen 16ths equal 1 inch. Eight 8ths equal 1 inch. Four 4ths equal 1 inch. Two halves equal 1 inch. Twelve inches equal 1 foot.

- All rules are read similarly. However, rules may have different graduations, and some rules may have special markings for specific purposes. A layout rule, for instance, is marked every 16 inches as an aid in determining stud locations on 16-inch centers.

- Procedures for rule usage.

  1. Align the end of the rule with one reference point.
  2. Determine the number of whole units between end of rule and second reference point.

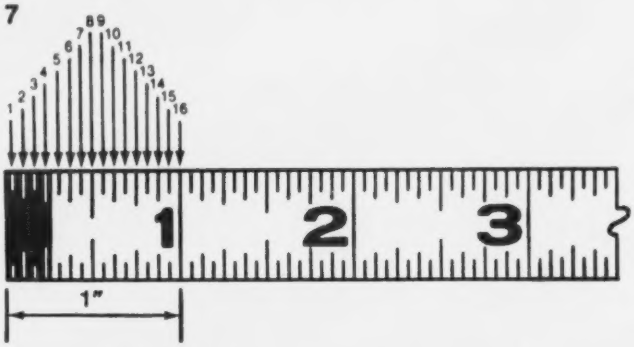
     NOTE: The unit of measurement will vary, depending on the distance being measured and the use being made of the measurement. Most short measurements are made in inches, even if they are more than 1 foot long. Skilled workers are generally able to quickly convert measurements from feet to inches or vice versa for distances of 10 to 12 feet or more. Thus, a worker may speak of a sheet of plywood as 4 by 8 feet or as 48 by 96 inches.

3. Determine the number of fractional units between last whole unit and second reference point.

   a. Determine number of graduations per inch. (Figure 7)

      NOTE: At first you may have to count the number of divisions in an inch. However, with some practice, you will be able to recognize the divisions on sight and will eventually be able to determine fractional units just by looking at the rule.

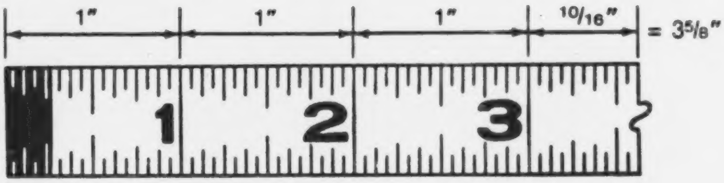
FIGURE 7



   b. Determine the fractional part of an inch by counting the number of divisions between last inch and second reference point.

   c. Reduce the fraction if possible. (Figure 8)

FIGURE 8

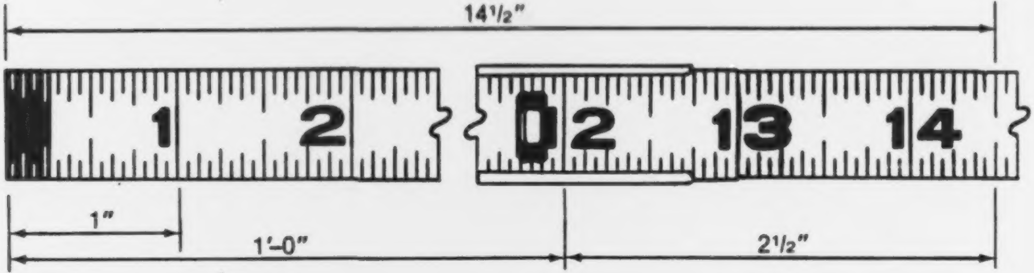


NOTE: In the example above, the rule is divided into sixteenths. There are ten divisions between the last inch mark—3 inches—and the reference point. The ¹⁰⁄₁₆ can be reduced to ⅝.

4. Determine the reading by adding fractional units to whole units and converting inches to feet or feet to inches if necessary. (Figure 9)

   EXAMPLE: The rule below shows a measurement of 1′-2½″ or 14½″.

FIGURE 9

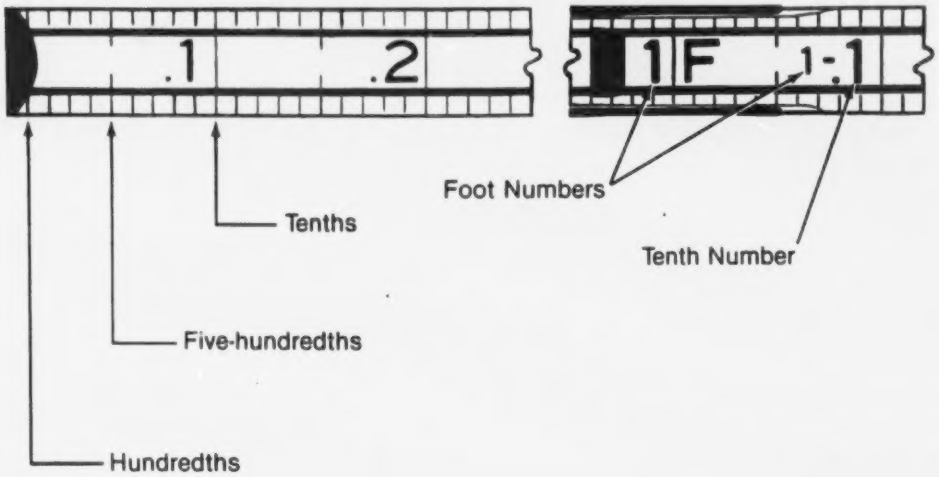


OBJECTIVE 5 **Solve problems by reading an engineer's rule.** (Assignment Sheet 2)

- Engineer's Rule Layout

  NOTE: Many engineer's rules contain running foot indicators. (Figure 10)

FIGURE 10



NOTE: Ten 100ths equal 1/10 of a foot. Two 5/100ths equal 1/10 of a foot. Ten 10ths equal 1 foot. Notice that the other graduations on the engineer's rule are also commonly referred to. For example, twenty-five hundredths (0.25) is the same as ¼ foot or 3 inches, and fifty hundredths (0.50) is the same as ½ foot or 6 inches.

- Procedures to read an engineer's rule to the nearest hundredth of a foot

  1. Align the end of the rule with one reference point.
  2. Determine the number of whole units between end of rule and second reference point.

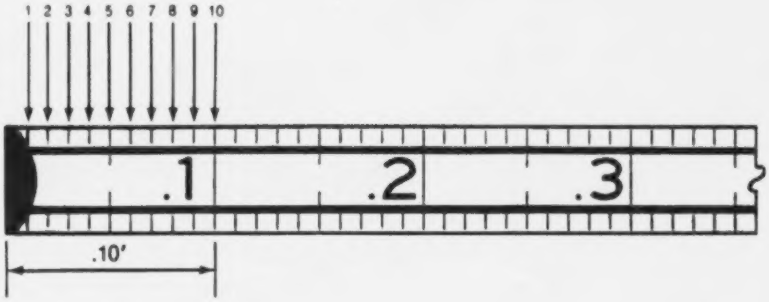
     NOTE: The units may be feet or tenths of a foot, depending on the distance measured and the use to be made of the measurement.

3. Determine the number of decimal units between last whole unit and second reference point.

   a. Determine the number of graduations per unit. (Figure 11)

      EXAMPLE: A rule marked off in tenths of a foot may have graduations for each tenth of a tenth or each hundredth of a foot.

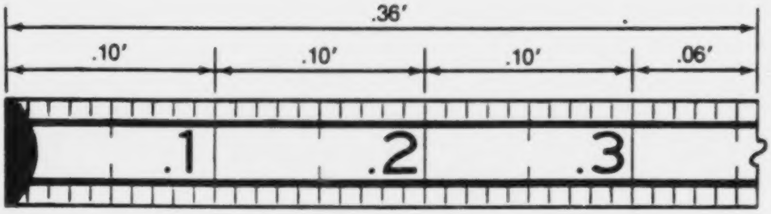
FIGURE 11



   b. Count the number of hundredths between last full tenth and second reference point (Figure 12)

      EXAMPLE: The following rule shows a measurement of 36 hundredths of a foot, or 0.36′.

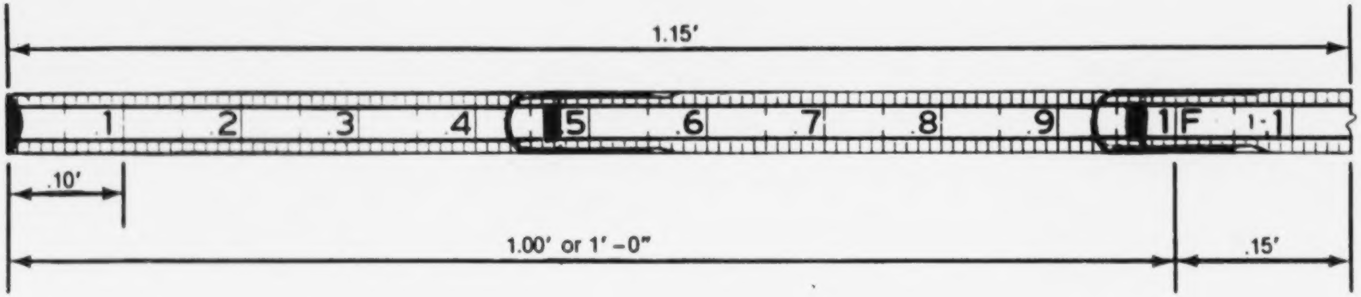
FIGURE 12



4. Determine the reading by adding decimal units to whole units and converting to feet and decimal parts of a foot if desired. (Figures 13 and 14)

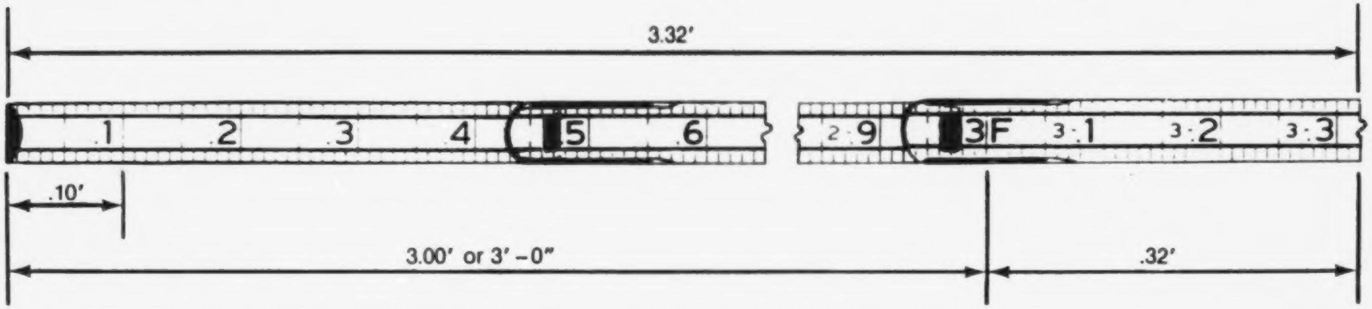
EXAMPLE 1: The rule below shows a measurement of 115 hundredths of a foot, or 1.15′.

FIGURE 13


1.15′
1
2
3
4
5
6
7
8
9
1F
1·1
.10′
1.00′ or 1′–0″
.15′

EXAMPLE 2: The rule below shows a measurement of 332 hundredths of a foot, or 3.32′.

FIGURE 14


3.32′
1
2
3
4
5
6
2·9
3F
3·1
3·2
3·3
.10′
3.00′ or 3′–0″
.32′

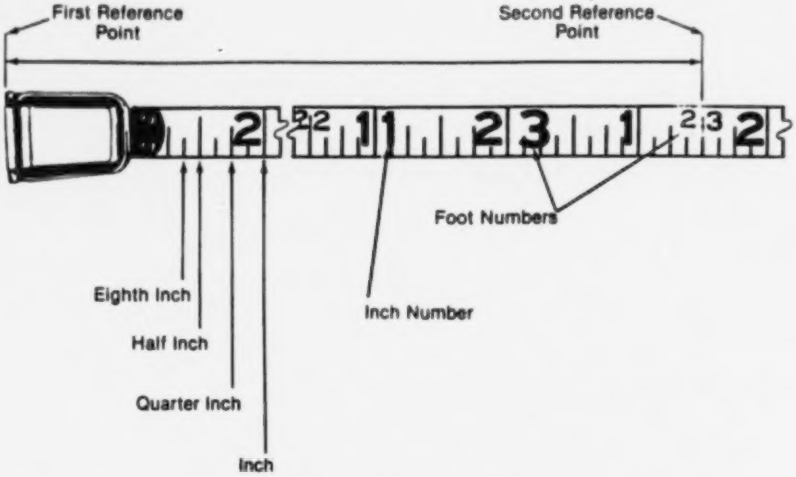
OBJECTIVE 6

Compute responses to problems by reading a tape.
(Assignment Sheet 3)

- Tape layout

  NOTE: The graduations on tapes are same as the various graduations on rules, but because tapes are used to measure long distances, most tapes contain running foot indicators.

FIGURE 15


First Reference Point
Second Reference Point
2
22 11
1
2
3
1
23
2
Foot Numbers
Eighth Inch
Half Inch
Quarter Inch
Inch
Inch Number

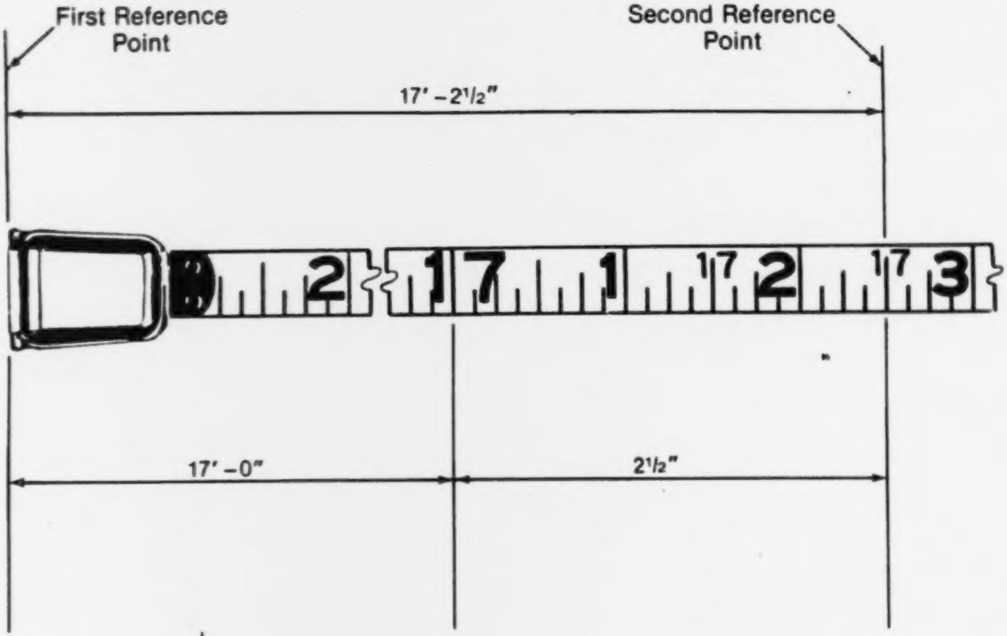
NOTE: The tape in Figure 15 reads twenty-three and one and one-half inches (23'-1½") at the second reference point.

- Procedures to read a tape

  1. Place end of tape on one reference point.
  2. Reading from starting end of tape, determine number of feet to second reference point.
  3. Determine number of inches between last whole-foot mark and second reference point.
  4. Determine fractional inches between last whole-inch mark and second reference point.
  5. Add feet, inches, and fraction of an inch to obtain correct measurement. (Figure 16)

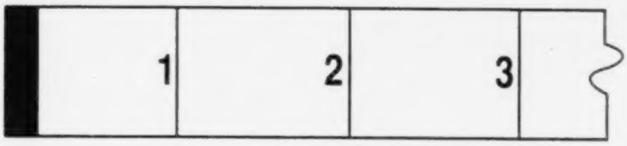
EXAMPLE: The tape below reads seventeen feet two and one-half inches (17'-2½") at the second reference point.

FIGURE 16

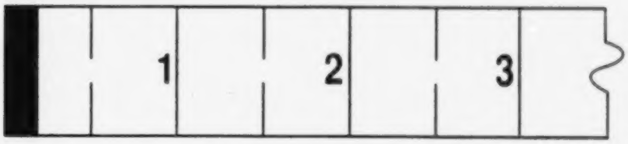

First Reference Point
Second Reference Point
17' – 2½"
2
1
7
1
17
2
17
3
17' – 0"
2½"

Graduations on a Rule

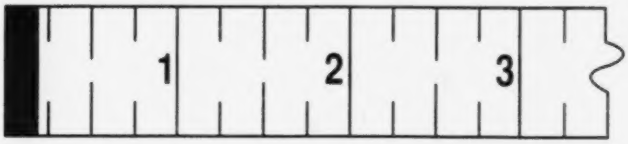
Inches



Halves

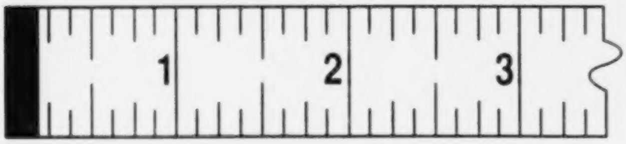


Quarters or Fourths

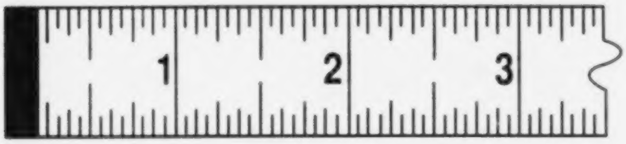


Graduations on a Rule
(Continued)

Eighths

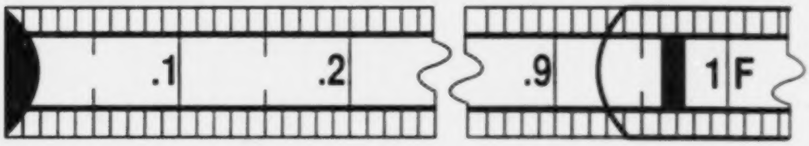


Sixteenths

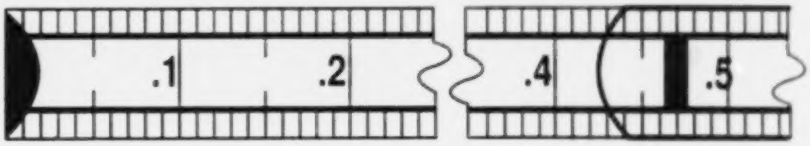


Graduations on an Engineer's Rule

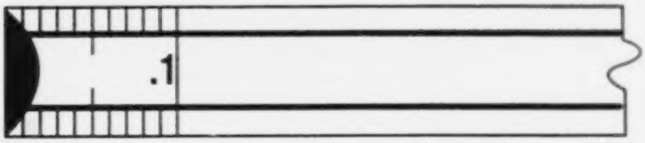
Ten 10ths equal 1 foot.



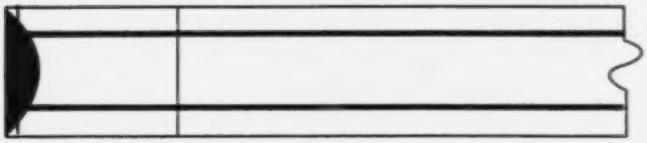
Five 10ths equal 6 inches or 1/2 foot.



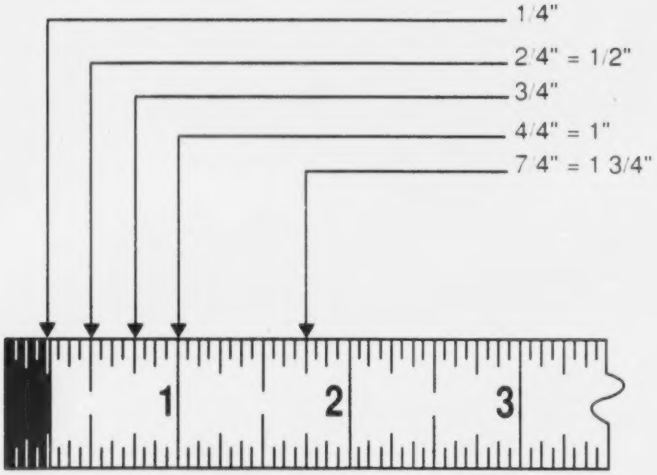
One 10th equals 1/10 of a foot or ten 100ths.



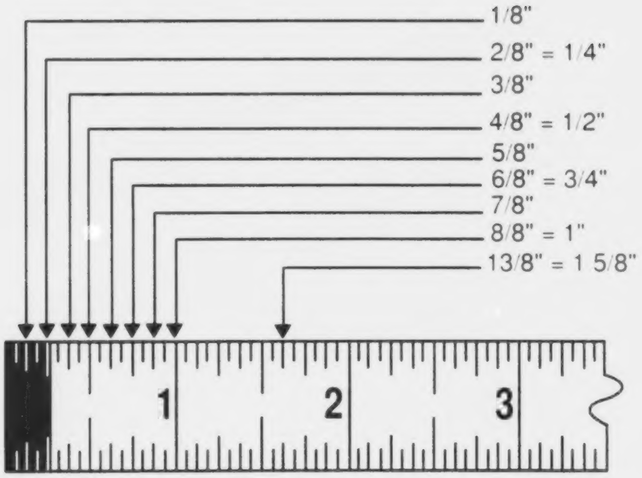
One 100th equals 1/10 of a 10th.



Reading Fourths on a Rule

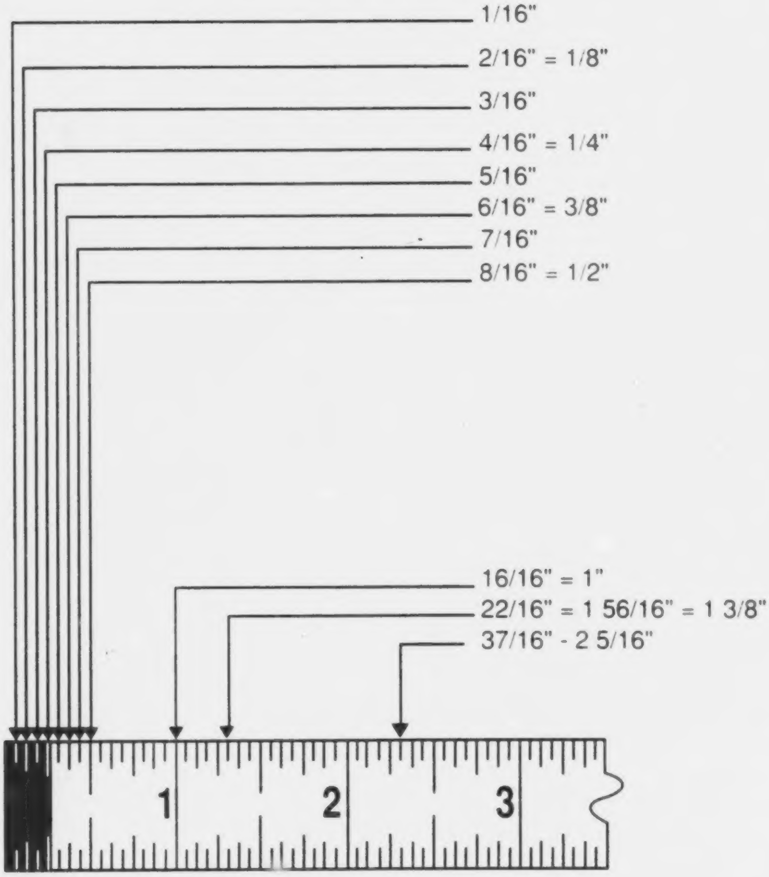

1/4"
2/4" = 1/2"
3/4"
4/4" = 1"
7/4" = 1 3/4"
1
2
3

Reading Eighths on a Rule


1/8"
2/8" = 1/4"
3/8"
4/8" = 1/2"
5/8"
6/8" = 3/4"
7/8"
8/8" = 1"
13/8" = 1 5/8"
1
2
3

votech

Reading Sixteenths on a Rule


1/16"
2/16" = 1/8"
3/16"
4/16" = 1/4"
5/16"
6/16" = 3/8"
7/16"
8/16" = 1/2"
16/16" = 1"
22/16" = 1 56/16" = 1 3/8"
37/16" - 2 5/16"
1
2
3

votech

ASSIGNMENT SHEET 1 — MEASURING — C 1

Name ________________________ Score ________

OBJECTIVE 4 **Calculate the correct responses to problems by reading a rule.**

INTRODUCTION

The first step in being able to make accurate measurements is to become familiar with the graduations on rules and how to read them. This assignment sheet gives you the opportunity to practice reading measurements on rules.

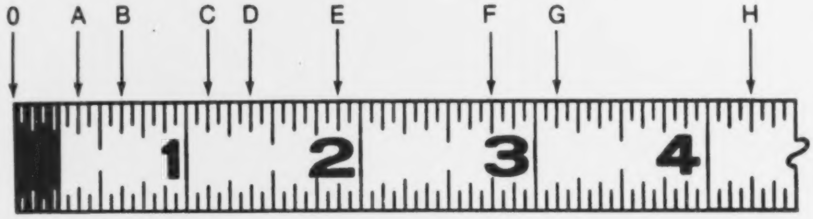
INSTRUCTIONS

Reading Comprehension Skills
- Gain factual information

Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

General Science Skills
- Use scientific instruments

1. Read the rule illustrated below. Write your answers on the lines provided.



a. O to A = ________

b. A to B = ________

c. O to C = ________

d. A to D = ________

e. B to D = ________

f. O to E = ________

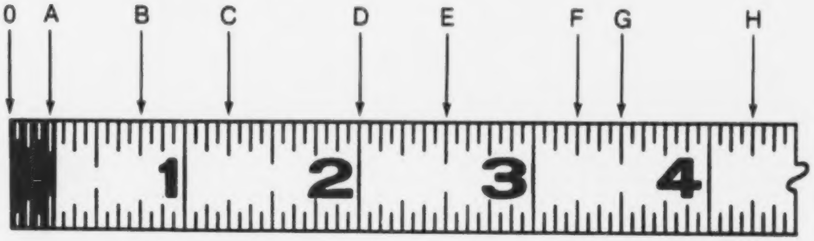
g. C to E = ________

h. B to F = ________

i. D to G = ________

j. A to H = ________

2. Read the rule illustrated below. Write your answers on the lines provided.



a. O to A = ________

b. A to B = ________

c. O to C = ________

d. B to D = ________

e. A to E = ________

f. O to F = ________

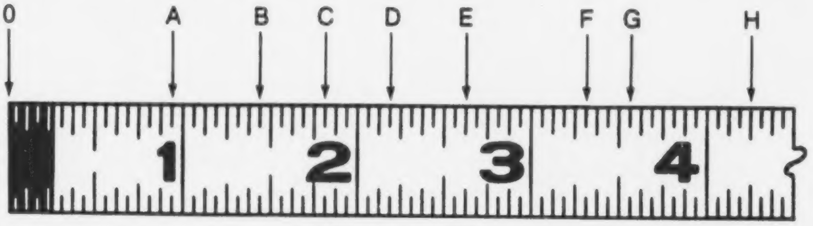
g. D to F = ________

h. C to G = ________

i. A to H = ________

j. E to H = ________

3. Read the rule illustrated below. Write your answers on the lines provided.



a. O to A = ________

b. A to B = ________

c. O to C = ________

d. B to D = ________

e. A to E = ________

f. O to F = ________

g. C to F = ________

h. A to G = ________

i. O to H = ________

j. E to H = ________

ASSIGNMENT SHEET 2 — MEASURING — C 1

Name ______________________________ Score ________

OBJECTIVE 5 **Solve problems by reading an engineer's rule.**

INTRODUCTION

Many rules are marked in hundredths of a foot. Often the worker is required to convert inch dimensions to decimal fractions of a foot. This exercise will help you become more proficient at converting fractional inches to hundredths of a foot while using an engineer's rule.

INSTRUCTIONS

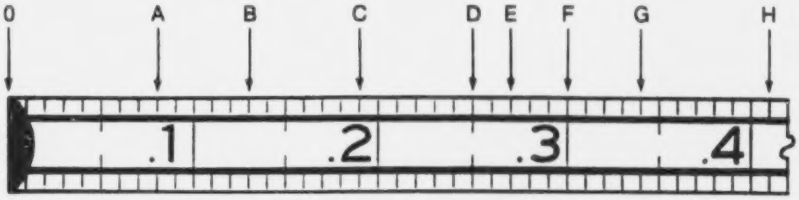
Reading an engineer's rule

1. Read the engineer's rule illustrated below to the nearest hundredth of a foot. Write your answers on the lines provided.

Reading Comprehension Skills
- Gain factual information

Functional Reading Skills
- Interpret graphics and symbols

Operation and Calculation Skills
- Converts units of measure



a. O to A = ________

b. A to B = ________

c. O to C = ________

d. B to E = ________

e. O to D = ________

f. C to F = ________

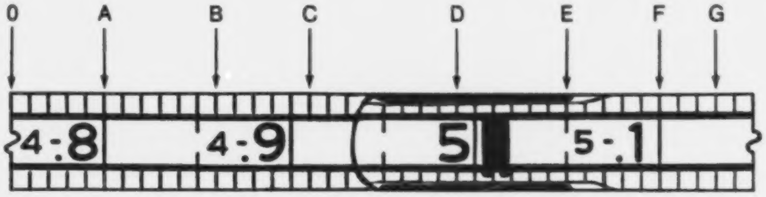
g. D to G = ________

h. O to F = ________

i. E to H = ________

j. O to H = ________

2. Read the engineer's rule illustrated below to the nearest hundredth of a foot. Write your answers on the lines provided.



a. 0 to A = ________

b. 0 to B = ________

c. 0 to C = ________

d. 0 to D = ________

e. 0 to E = ________

f. 0 to F = ________

g. 0 to G = ________

h. A to D = ________

i. B to F = ________

j. C to G = ________

Name ______________________________ Score __________

OBJECTIVE 6

Compute responses to problems by reading a tape.

INTRODUCTION

This exercise will help you to develop a better knowledge of reading a tape and will help you to read a tape quickly and efficiently.

INSTRUCTIONS

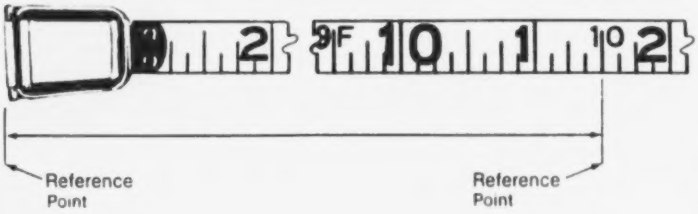
Using the procedures outlined in Objective 6 of the Information Sheet, read the following tapes and write the correct dimensions on the lines between the reference points.

Reading Comprehension Skills
- Gain factual information

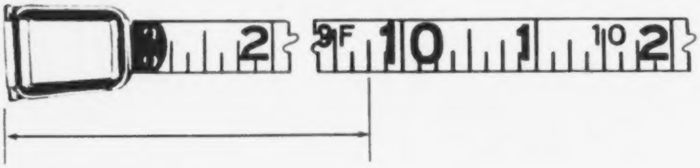
Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

General Science Skills
- Use scientific instruments

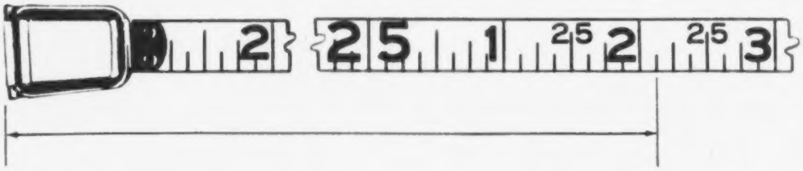
1.



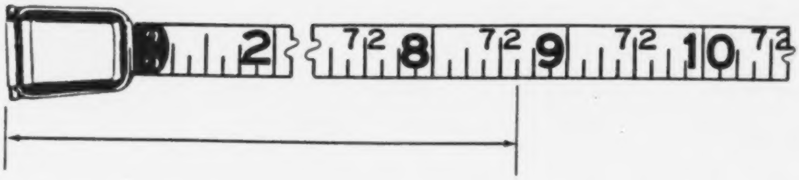
2.



3.



4.


2
72
8
72
9
72
10
72

ASSIGNMENT SHEET 1

1.	a.	⅜"	f.	1⅞"	2.	a.	¼"	f.	3¼"
	b.	¼"	g.	¾"		b.	½"	g.	1¼"
	c.	1⅛"	h.	2⅛"		c.	1¼"	h.	2¼"
	d.	1	i.	1¾"		d.	1¼"	i.	4"
	e.	¾"	j.	3⅞"		e.	2¼"	j.	1¾"
3.	a.	15/16"	f.	3 9/16"					
	b.	½"	g.	1½"					
	c.	1 13/16"	h.	2⅝"					
	d.	¾"	i.	4¼"					
	e.	1 11/16"	j.	1⅝"					

ASSIGNMENT SHEET 2

1.	a.	0.08′	f.	0.11′	2.	a.	4.80′	f.	5.10′
	b.	0.05′	g.	0.09′		b.	4.86′	g.	5.13′
	c.	0.19′	h.	0.30′		c.	4.91′	h.	0.19′
	d.	0.14′	i.	0.14′		d.	4.99′	i.	0.24′
	e.	0.25′	j.	0.41′		e.	5.05′	j.	0.22′

ASSIGNMENT SHEET 3

1. 10′-1½″
2. 9′-11¾″
3. 25′-2⅛″
4. 72′-8⅝″

WRITTEN
TEST

MEASURING

C 1

Name ______________________________ Score __________

OBJECTIVE 1

Given a list of terms associated with measuring, match them to their correct definitions. Write in the letter that corresponds to the most correct answer.

_____ 1. A numerical notation to denote distances between two points is called a/an

a. division
b. lineal
c. dimension
d. perimeter

_____ 2. Unit of measure consisting of twelve equal parts called inches is a

a. foot
b. yard
c. meter
d. rod

_____ 3. The outer limits or boundary is called the

a. dimension
b. ring
c. division
d. perimeter

_____ 4. Which of the following terms describe a plan or design of the project to be constructed?

a. Perimeter
b. Layout
c. Schedule
d. Dimension

May be photocopied for student use.

_____ 5. A *taut* line can best be described as one that is

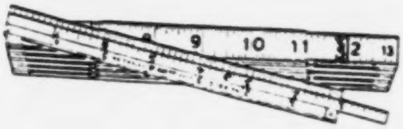
a. loose
b. tightly stretched
c. intersected with one or more lines
d. coated with waterproofing

_____ 6. A part of a whole that represents one or more equal parts of a unit is called a

a. keel
b. whole unit
c. fraction
d. lineal line

OBJECTIVE 2 **Provided a picture, choose the appropriate name for a measuring tool.**

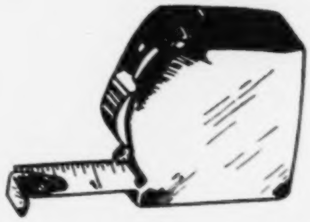
_____ 1. The picture shown below represents a



a. folding rule
b. leveling rod
c. framing square
d. speed square

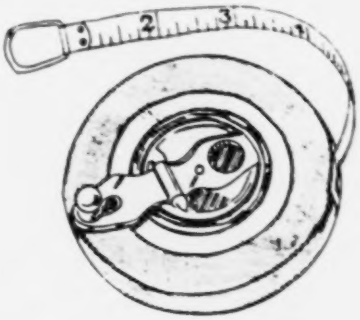
May be photocopied for student use

_____ 2. The picture below represents a/an



a. engineer's folding rule
b. spring-balanced tape
c. surveyor's steel tape
d. retractable steel tape

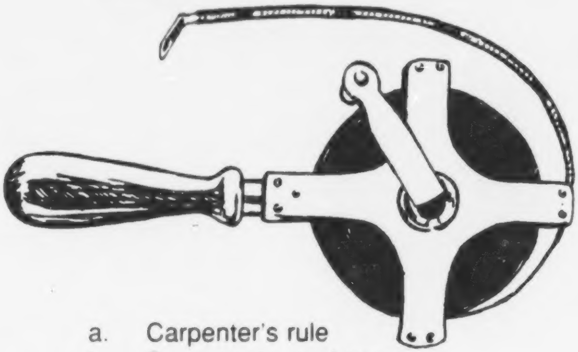
_____ 3. What is the measuring tool represented in the picture below?



a. Folding rule
b. Retractable steel tape
c. Steel tape
d. None of the above

May be photocopied for student use.

_____ 4. Which of the following terms is best used to describe the measuring tool shown below?



a. Carpenter's rule
b. Surveryor's steel tape
c. Steel tape
d. Plumb bob

OBJECTIVE 3 **Select from a list of alternatives, solutions to common errors in making measurements.**

_____ 1. Which of the following statements represent solutions to the most common measurement error?

a. Removing slack in tape
b. Laying the tape flat
c. Aligning the tape or rule properly
d. All of the above

_____ 2. A common solution to tape measurement errors is to be sure you

a. place the tape end on the reference point.
b. place slack in the tape.
c. leave the tape kinked.
d. leave the tape twisted.

NOTE: Objectives 4-6 are evaluated on assignment sheets in this unit. If you have not completed these components, see your instructor.

May be photocopied for student use

WRITTEN TEST ANSWERS

MEASURING

C 1

OBJECTIVE 1

1. c
2. a
3. d
4. b
5. b
6. c

OBJECTIVE 2

1. a
2. d
3. c
4. b

OBJECTIVE 3

1. d
2. a

OBJECTIVE SHEET

PLAN READING

C 2

INTRODUCTION

Building plans consist of drawings and written material needed to communicate information about the construction process. This information must be presented in a consistent and reliable form so as to serve people involved in all aspects of building construction.

UNIT OBJECTIVES

After completing this unit, the student will be able to define architectural terms and use scales. The student will show this knowledge by completing the assignment sheets and written test with a minimum score of 85 percent.

SPECIFIC OBJECTIVE

After completing this unit, the student will be able to:

1. Given a list of architectural terms associated with plan reading, match them to their correct definitions.
2. Given alternatives, match each document within a set of building plans to its purposes.
3. Choose the proper definition for types of architectural lines.
4. Solve problems in reading an architect's and an engineer's scale. (Assignment Sheet 1)

PLAN READING

PREPARATION

- Study the specific objectives to determine the order in which you will present the objectives. Decide whether or not you wish to add additional objectives.

- Review teaching suggestions given in the Delivery section and plan classroom activities.

- Plan presentation to take advantage of student learning styles and to accommodate students with special needs.

- Order or obtain materials listed in suggested resources.

- Order other materials to supplement unit.

EXAMPLES: Architect's scales for each student, copy of the latest edition of *Architectural Graphic Standards* by Ramsey and Sleeper, and a copy of *Residential Print Reading* by Leonard P. Toenjes. Illustrations of different types of period construction, such as Early American, Old English, Cape Code, French

DELIVERY

Objective 1: Given a list of architectural terms associated with plan reading, match them to their correct definitions.

- Show students examples to illustrate appropriate terms.

- Show students examples of perspective, mechanical, and structural drawings when discussing these terms.

- Explain how knowing the terms and definitions will help the student to better understand this unit.

Objective 2: Given alternatives, match each document within a set of building plans to its purposes.

- Discuss the types of drawings usually included in a set of plans.

- Show students examples of perspective, mechanical, and structural drawings and emphasize the importance of them being able to visualize and sketch a plan or object.

APPLICATION

Objective 3: Choose the proper definition for types of architectural lines.

- Discuss and illustrate the definitions for the alphabet of lines.

Objective 4: Solve problems in reading an architect's and an engineer's scale. (Assignment Sheet 1)

- Review the use of an architect's and an engineer's scale using transparency 1.

- Refer to the unit titled "Measuring" if additional instruction is needed.

- Assign students to complete the Assignment Sheet 1.

EVALUATION

Pretest

- Give written test as pretest.

- Determine individual study requirements from pretest results.

- Counsel students individually on pretest results and study requirements.

- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.

- Evaluate students on job sheet activities.

- Complete appropriate section of competency profiles.

- Reteach and reevaluate if necessary.

- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.
- Evaluate students on assignment sheet activities.

  NOTE: The written test may be given in sections if desired.
- Give the written test.
- Reteach and retest if necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

AGC Resources

- "Measuring" unit from *Fundamentals of Carpentry*. Oklahoma Department of Vocational and Technical Education/ Curriculum and Instructional Materials Center, 1500 West 7th Avenue, Stillwater, Oklahoma 74074 or the Associated General Contractors of America, 1957 E Street, N.W., Washington, D.C. 20006.

Other Resources

- *Architectural Graphic Standards*. John Wiley and Sons, Inc.: New York, NY.

  NOTE: When ordering resource materials be sure to order the newest editions.

UNIT REFERENCES

- Willey, Al. *Fundamentals of Carpentry*. Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America: Stillwater, OK, 1993.
- *Modern Carpentry*. The Goodheart-Willcox Co., Inc.: South Holland, IL.
- Toenjes, Leonard P. *Residential Printreading*. American Technical Publishers, Inc: 1989.

OBJECTIVE 1

Given a list of architectural terms associated with plan reading, match them to their correct definitions.

- **actual dimension** — exact measured size of a unit

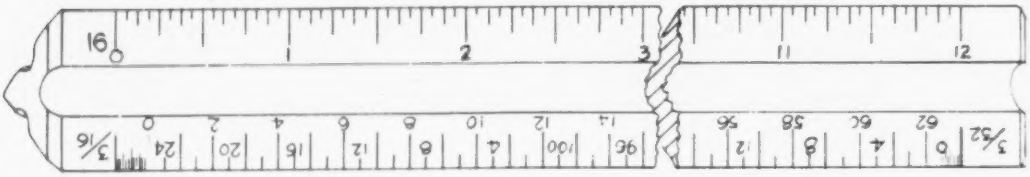
  EXAMPLES: A 2x4 board is actually 3½ by 1½ inches; an 8″ x 8″ x 16″ concrete block is actually 7½ x 7½ x 15½ .

- **architect's drawings** — set of detailed working drawings or plans drawn to scale by an architect, showing all information and dimensions necessary to build or remodel a structure

  NOTE: The architect's drawings consist of several different kinds of drawings, usually assembled into a set: plot plan, foundation plan, floor plan(s), elevation drawings, section drawing(s), and detail drawings. The set will also include finish schedules and may include a perspective drawing, a structural drawing, and a mechanical drawing.

- **architect's scale** — three-sided rule with six ruled faces designed to measure in twelve different scales of proportional feet and inches (Figure 1)

FIGURE 1



- **bench mark** — point of known or assumed elevation used by surveyor as a reference point in determining other elevations

- **blueprints** — reproductions of architect's drawings; also called *plans* or *construction plans*

  NOTE: A true blueprint has white lines on a blue background; however, most of today's reproductions produce a black-, blue-, and sepia-colored line on a white background.

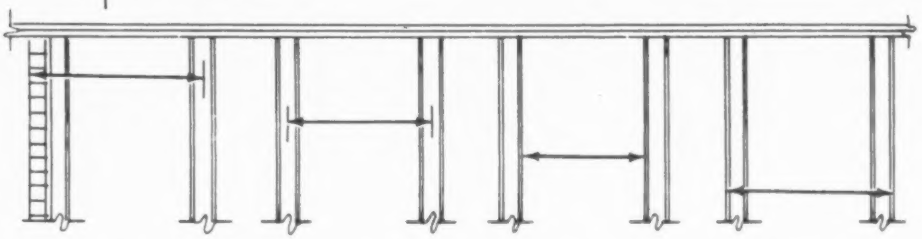
- **contour lines** — lines used on plot plans and topographical surveys to show both natural grade and finish grade elevations

- **convention** — an architect's standard method to represent dimensions and structural details on blueprints.

- **dimensioning** — using dimension lines and figures to indicate actual sizes and distances of objects and spaces represented

  NOTE: Dimensioning may be from outside to center, center to center, wall to wall, or outside to outside. (Figure 2) In all cases, dimensions are given in actual size regardless of the fact that the plan shows an object or distance on a smaller scale. Section and detail views may use nominal sizes in labeling.

FIGURE 2



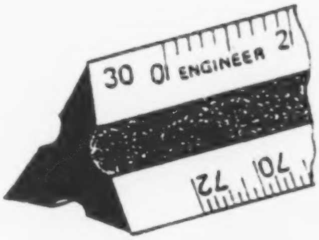
Outside to Center   Center to Center   Wall to Wall   Outside to Outside

- **elevation (1)** — given grade

- **elevation (2)** — a view showing the outside oft he structure

- **engineer's scale** — three-sided rule with six-ruled faces that is read in one direction only, contains no inch divisions of a foot. (Figure 3)

FIGURE 3



- **finish schedule** — listing or chart of parts (keyed to the plans), amounts, materials or products, and details (Figures 4 and 5)

  NOTE: Schedules may appear on same page as a plan or on a separate page in the set of plans. Schedules may be listed for windows, doors, room finishes, floor types and finishes, paint, appliances, fixtures, lintels, headers, and reinforcing steel.

FIGURE 4

DOOR SCHEDULE FOR ENTIRE HOUSE			
MARK	SIZE	AMT REQ'D	REMARKS
A	5′-0″ × 6′-8″ × 1¾″	1	EXTERIOR FLUSH DOOR
B	2′-8″ × 6′-8″ × 1¾″	7	FLUSH DOORS 1-SLIDING 1-METAL CLAD
C	2′-6″ × 6′-8″ × 1⅜″	4	FLUSH DOOR
C_1	2′-6″ × 6′-8″ × 1⅜″	2	LOUVERED
D	2′-4″ × 6′-8″ × 1⅜″	4	FLUSH DOOR
D_1	2′-4″ × 6′-8″ × 1⅜″	1	LOUVERED
E	1′-3″ × 6′-8″ × 1⅜″	1	BIFOLD LOUVERED
F	2′-10″ × 6′-8″ × 1¾″	2	EXTERIOR 2 LIGHTS
G	2′-8″ × 6′-8″ × 1¾″	1	EXTERIOR 2 LIGHTS

FIGURE 5

WINDOW SCHEDULE		
MARK	SIZE	REMARKS
A	(2) 3′-0″ x 4′-2″	DH SEE SPECS
B	(2) 3′-0″ x 3′-2″	"
C	—	TRIMLINE BAY 53R
D	2′-7″ x 4′-2″	DH SEE SPECS
E	1′-6″ x 3′-2″	"
F	2′-6″ x 2′-9″	231B CASEMENT
G	3′-0″ x 3′-2″	DH SEE SPECS
H	2′-0″ x 5′-5″	FIXED SEE SPECS

- **mechanical drawing** — drawing showing location and details about plumbing and electrical components and heating and air-conditioning units

  NOTE: Mechanical features may be drawn on the basic floor or foundation plan or may be shown in separate drawings.

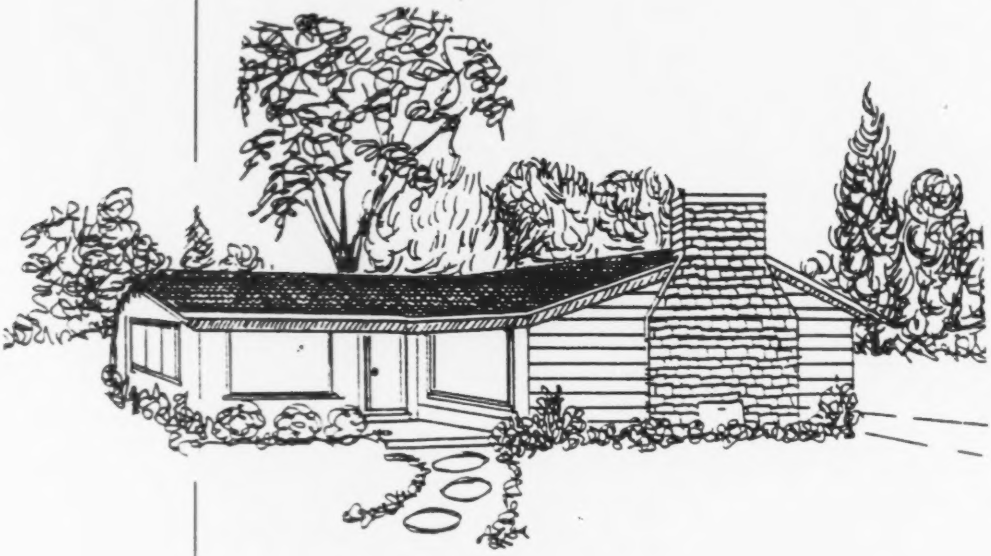
- **nominal dimension** — approximate or rough size of a unit

  EXAMPLES: 2x4 board, 8″ x 8″ x 16″ concrete block

- **perspective drawing** — drawings that have many of the features of a photograph (Figure 6)

  NOTE: Whenever perspective drawings are available, the trades worker should use them as an aid in visualizing the many details that appear on the construction plans.

FIGURE 6



- **scale drawing** — drawing made to a size either proportionally larger or smaller than the actual size of the object represented

  NOTE: The scale to which the architect makes a drawing is always indicated on the drawing, generally below the title. Detail and section drawings may be drawn on a larger scale than the other drawings in the set of plans.

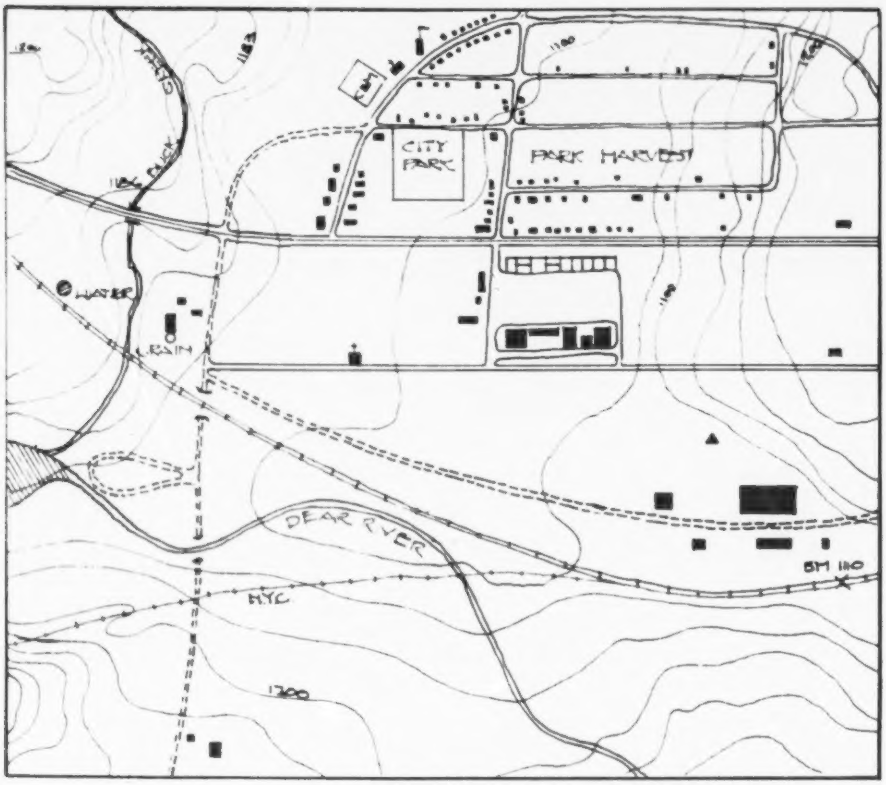
- **specifications** — detailed set of written instructions that supplements the set of plans, describes equipment and materials used in the structure

- **structural drawing** — drawing by a structural engineer that may accompany architect's plans and that gives important information about the foundation, frame, and floor system

  NOTE: Structural drawings are usually drawn for large structures such as an office building or factory.

- **topographical survey** — drawing of natural and man-made features of a place or region showing their relative positions and elevations (Figure 7)

FIGURE 7


CITY PARK
PARK HARVEST
WATER
BASIN
DEAR RIVER
NYC
BM 110
1200

OBJECTIVE 2 **Given alternatives, match each document within a set of building plans to its purpose.**

- **plot plan** — horizontal view showing where the building is to be located on the site

- **foundation plan** — horizontal view of entire masonry substructure below first floor or frame of building

- **floor plan** — horizontal view of building, showing length and breadth of building and layout of rooms on that floor

- **elevation** — vertical, two-dimensional view of each of the exterior faces of a building, showing general shape and design of exterior and roof

- **section** — cut-away vertical view through an object or wall to show its interior makeup

  NOTE: A section view is limited to the specific portion of the building the architect wishes to clarify, and may be drawn on the same sheet as an elevation or plan or may appear on a separate sheet.

- **detail** — graphic, at a larger scale, of part of another drawing, indicating special features of design, location, and composition and the correlation of the elements and materials shown

  NOTE: Detail drawings often use the cut-away section view to show aspects that are too small to be shown in sufficient detail on plan or elevation drawings. Like section drawings, detail drawings may be drawn on the same sheet as an elevation or plan drawing or may appear on a separate sheet in the set of plans.

- **finish schedule** — a listing of parts, amounts, materials or products and details

- **written specification** — Written specifications are equally as important as the drawings in a set of plans. They furnish what the drawings cannot, in that they give detailed and accurate written descriptions of work to be done, including quality and quantity of materials, methods of construction, standards of construction, and manner of conducting the work.

  - Avoiding disputes among builders, architects, and owners by leaving no room for misinterpretation or misunderstanding

  - Facilitating the checking of materials and workmanship during time that building is being constructed

  - Enabling contractors to make bids based on total materials and labor required

- Avoiding expensive omissions when estimating total costs
- Avoiding conflicting opinions during construction and avoiding the added costs and delays that could result

- **Information found on types of drawings in a set of plans**

Plot plan

- Location, dimensions, and elevation of structure on site
- Finished and existing grade contours
- Property lines and dimensions
- Location of utilities
- Location of existing conditions

  EXAMPLES: Trees, utility buildings, other structures

- Location and dimensions of driveways and walks

Foundation plan

- Location and dimensions of footings, grade beams, foundation walls, stem walls, piers, equipment footings, and foundations
- Location of anchor bolts (in detail view)

Floor plan

- Outside walls, including location and dimensions of all exterior openings
- Types of construction materials
- Location of interior walls and partitions
- Location and swing of doors
- Stairways

- Location of windows
- Location of cabinets, electrical and mechanical equipment, and fixtures
- Location of cutting plane line

Elevation

- Grade lines
- Floor height
- Window and door types
- Roof lines and slope, roofing material, vents, gravel stops, and projection of eaves
- Exterior finish materials and trim
- Exterior dimensions

Section

- Details of construction and information about stairs, walls, chimneys, or other parts of construction that may not show clearly on plan
- Floor levels in relation to grade
- Wall thickness at various locations
- Anchors and reinforcing steel

Detail

NOTE: The following list itemizes types of information that may require a detail drawing. All of the items listed would never appear on a single detail drawing.

- Footings and foundations, including anchor bolts, reinforcing, and control joints
- Beams, floor joists, bridging, and other support members

  - Sills, floor framing, exterior walls, and vapor barriers
  - Floor heights, thickness, expansion, and reinforcing
  - Interior walls
  - Windows, exterior and interior doors, and door frames
  - Roof, cornice, soffit, and ceilings
  - Gravel stops, fascia, and flashing
  - Fireplaces, and chimneys
  - Staircases, and stair assembly
  - Millwork, trim, ornamental iron, and specialty items

Written specifications

  - Owner's name and address
  - Architect's name
  - Location of structure
  - Completion date
  - Guarantees
  - Types and quality of building materials

OBJECTIVE 3 **Choose the proper definitions for types of architectural lines.**

- **Architectural drawings consist of:**
  - lines (alphabet of lines)
  - symbols
  - abbreviations

  - conventions
  - terms

- **Definitions of lines**
  - **object lines** — used to show main outline of structure, including exterior walls, interior partitions, porches, patios, sidewalks, parking lots, and driveways

    NOTE: Object lines are always the heaviest lines in the drawing.

  - **dimension line** — used to designate object and area dimensions

    NOTE: Dimension lines may end in arrows, dots, or slashes. The dimension is usually written above the dimension line.

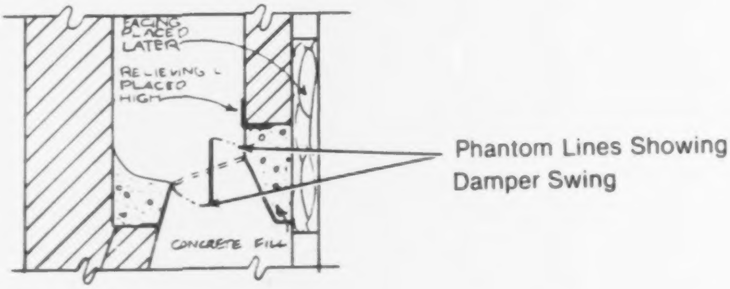
  - **extension lines** — used as parameters for dimension lines
  - **hidden line** — used to show lines that are not visible from view depicted
  - **center line** — used to designate center and to provide a reference point for dimensioning
  - **section line** — used to indicate an area that has been cut away and shown in a section view; arrows indicate direction from which section drawing is to be viewed
  - **phantom line** — used to indicate alternative positions of moving parts, adjacent positions of related parts, and for repeated details
  - **break line** — used to show that an object or area has not been drawn in its entirety
  - **leader line** — used to connect a note or dimension to a related part of the drawing

    NOTE: Leader lines are sometimes curved to avoid confusion with dimension lines and other lines.

- **Identify lines in the alphabet of lines.**

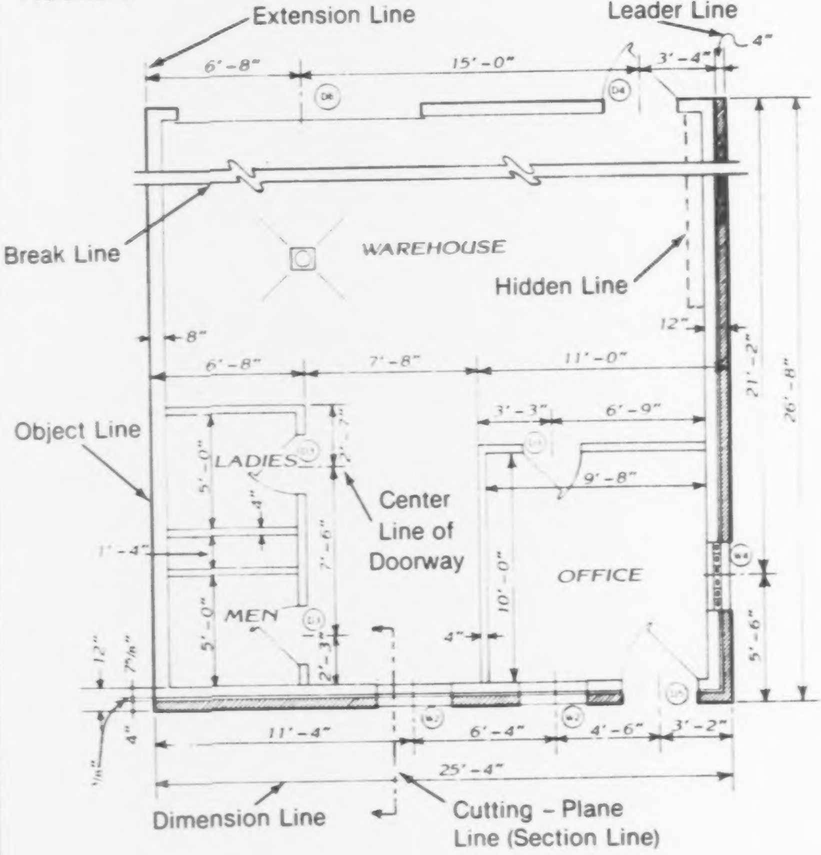
  - **Phantom line**

FIGURE 8


FACING PLACED LATER
RELIEVING L PLACED HIGH
CONCRETE FILL
Phantom Lines Showing Damper Swing

  - **Other lines**

FIGURE 9


Extension Line
Leader Line
4"
6'-8"
15'-0"
3'-4"
WAREHOUSE
Break Line
Hidden Line
12"
8"
6'-8"
7'-8"
11'-0"
21'-2"
26'-8"
3'-3"
6'-9"
9'-8"
Object Line
LADIES
5'-0"
7'-6"
Center Line of Doorway
1'-4"
10'-0"
OFFICE
MEN
5'-0"
2'-3"
4"
5'-6"
12"
7 1/2"
4"
11'-4"
6'-4"
4'-6"
3'-2"
25'-4"
Dimension Line
Cutting - Plane Line (Section Line)

OBJECTIVE 4

Solve problems by reading an architect's and an engineer's scale. (Assignment Sheet)

- Engineer's scale

  An engineer's scale is used for measuring when drawing plot plans; plot plans are drawn at a smaller scale than other drawings. Common size scales used are 1″ = 10′-0″, 1″ = 20′-0″, 1″ = 30′-0″ etc. (Figures 10-12)

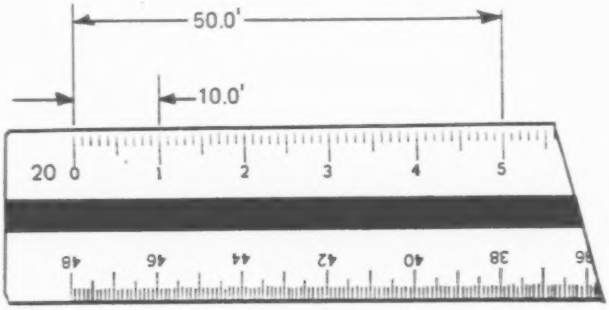
  An engineer's scale is used to check dimensions on plot plans.

- Architect's scale

  An architect's scale or rule is used to measure dimensions on drawings in twelve different scales of proportional feet and inches.

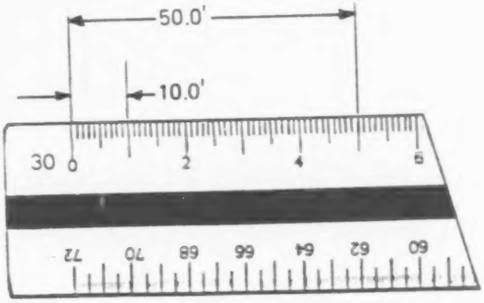
  — Scale is 1″ = 20′

FIGURE 10



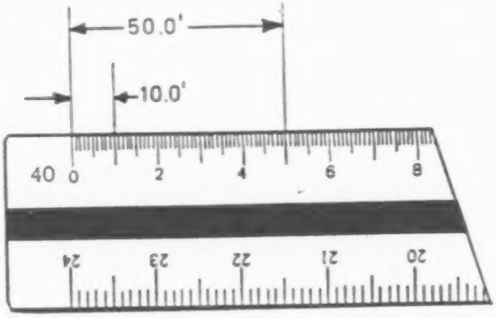
— Scale is 1″ = 30′

FIGURE 11


50.0′
10.0′
30
0
2
4
6
72
70
68
66
64
62
60

— Scale is 1″ = 40′

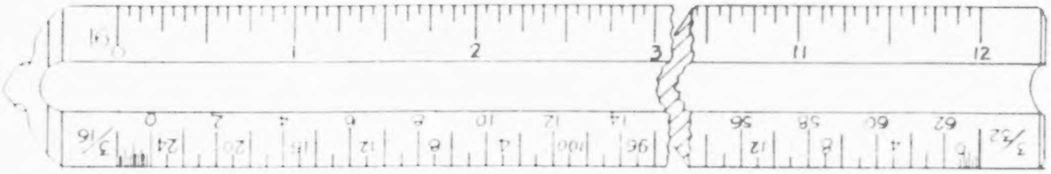
FIGURE 12


50.0′
10.0′
40
0
2
4
6
8
24
23
22
21
20

NOTE: Figures 10-12 are drawn to scale.

Architect's and Engineer's Scale

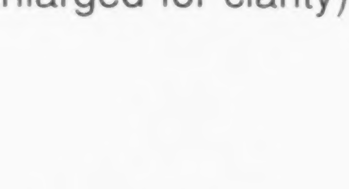
Architect's



Measurements at Scale of 12″ = 1′-0″

(Full Scale)

Engineer's



Measurements at Scale of 1:40 (1″ = 40′-0″)
(Enlarged for clarity)

PLAN READING

Name ______________________ Score __________

OBJECTIVE 3

Solve problems by reading an architect's and an engineer's scale.

INTRODUCTION

Construction workers need to be skilled in using an architect's and engineer's scale. Learning to read an architect's scale proficiently also aids in reading plans.

INSTRUCTIONS

Reading Comprehension Skills
- Gain factual information

Functional Reading Skills
- Follow written instructions

Data Analysis and Display Skills
- Interpret graphs

Section A:

Use an architect's scale to complete this assignment sheet. Keep in mind the following guidelines:

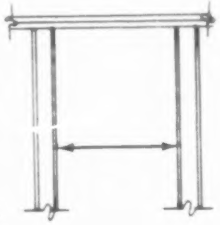
- Select proper scale ratio.
- Be sure that scale is lying flat on surface being measured.
- Double-check all measurements.
- Practice measuring from center of one line to center of next line.
- Do not use scale if dimensions are available.

NOTE: Accuracy may vary because of distortion due to the plan reproduction process.

Part 1

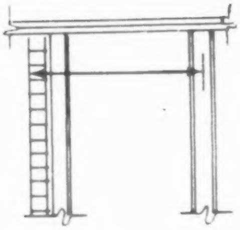
Use the architect's scale to find the following dimensions. Write your answers in the blanks.

______________ 1. Scale to 1/16" = 1'-0"

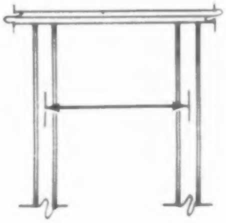


Job Acquisition/
Development Skills

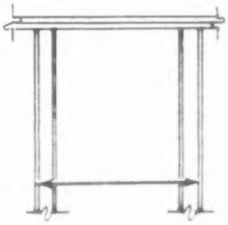
- Master specific job task/procedure
- Practice good work habits/attitudes



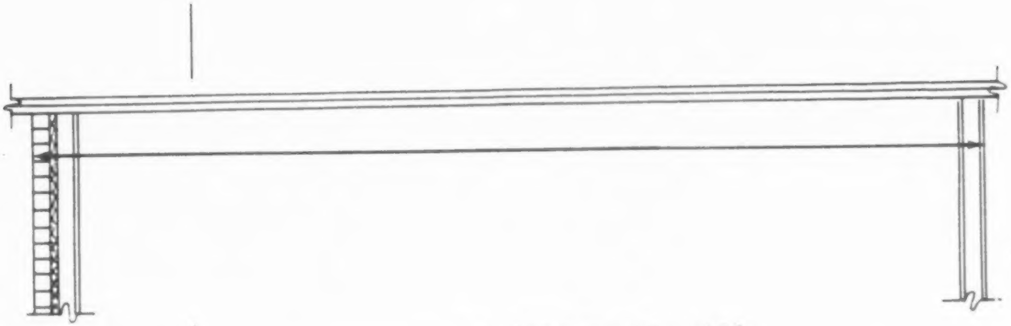
________________2. Scale to ⅛" = 1'-0"



________________3. Scale to ¼" = 1'-0"



________________4. Scale to ½" = 1'-0"

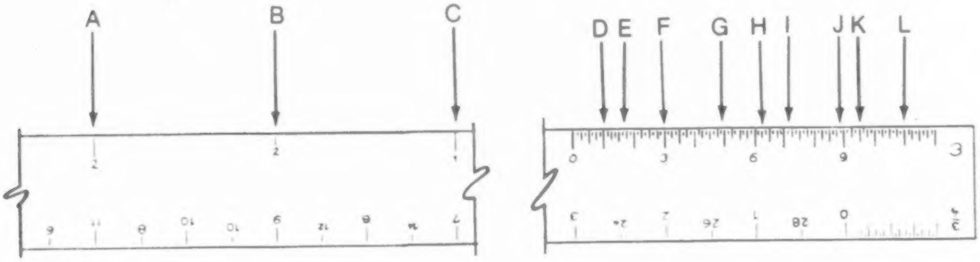


_______________ 5. Scale to 1½″ = 1′-0″

Part 2

Read the following scales from zero to the letter points indicated. Write the correct readings in the blanks below the scales.

1.



NOTE: This illustration has been reduced.

A = _______________

B = _______________

C = _______________

D = _______________

E = _______________

F = _______________

G = _______________

H = _______________

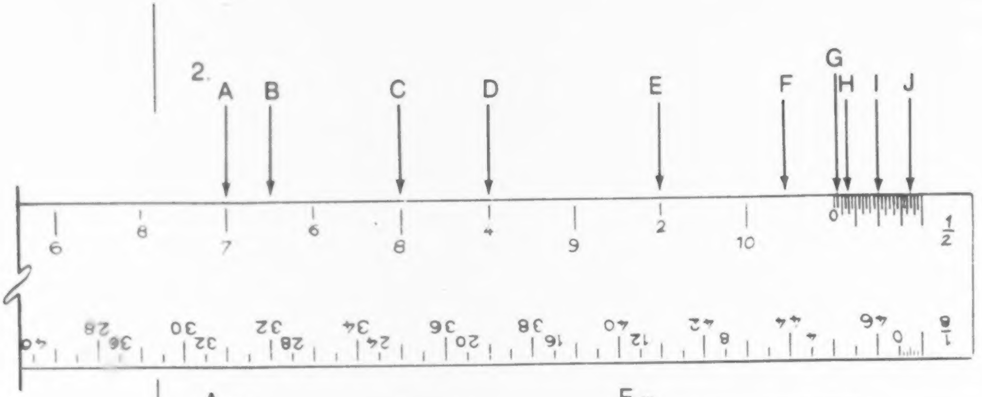
I = _______________

J = _______________

K = _______________

L = _______________

2.


A
B
C
D
E
F
G
H
I
J
0
$\frac{1}{2}$
$\frac{1}{8}$

A = ____________

B = ____________

C = ____________

D = ____________

E = ____________

F = ____________

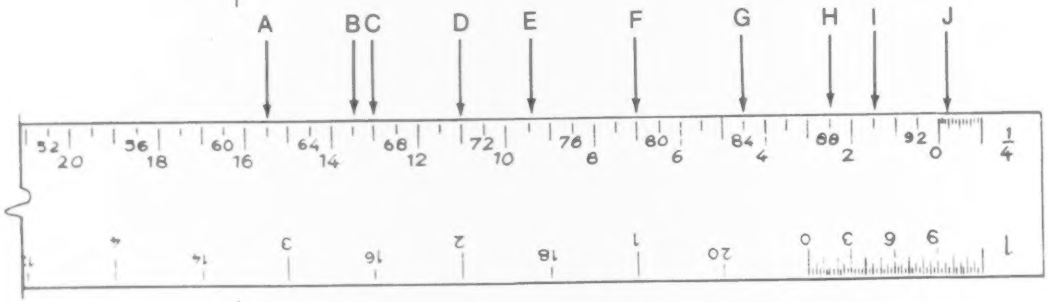
G = ____________

H = ____________

I = ____________

J = ____________

3.


A
B
C
D
E
F
G
H
I
J
0
$\frac{1}{4}$
1

A = ____________

B = ____________

C = ____________

D = ____________

E = ____________

F = ____________

G = ____________

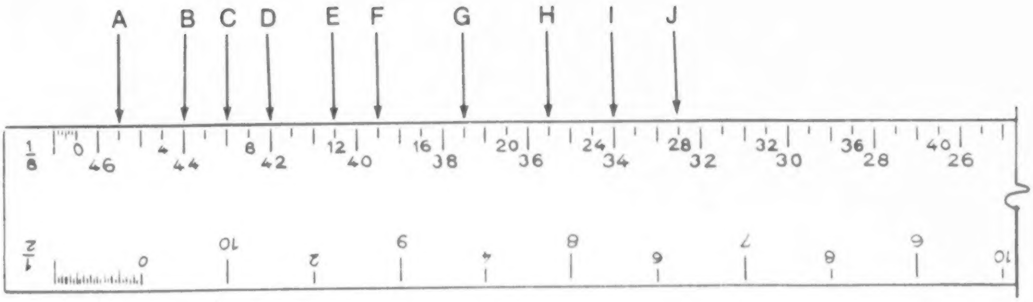
H = ____________

I = ____________

J = ____________

votech

4.


A
B
C
D
E
F
G
H
I
J
1/8
0
4
8
12
16
20
24
28
32
36
40
46
44
42
40
38
36
34
32
30
28
26
1/2
0
10
2
6
4
8
6
7
8
9
10

A = ______________

B = ______________

C = ______________

D = ______________

E = ______________

F = ______________

G = ______________

H = ______________

I = ______________

J = ______________

INSTRUCTIONS

Reading Comprehension Skills
- Gain factual information

Functional Reading Skills
- Follow written instructions

Section B:

Use an engineer's scale to complete this assignment sheet. Keep in mind the following guidelines:

- Select proper scale ratio.
- Be sure scale is lying flat on surface being measured.
- Double-check all measurements.
- Practice measuring from center of one line to center of next line.
- Do not use scale if dimensions are available.

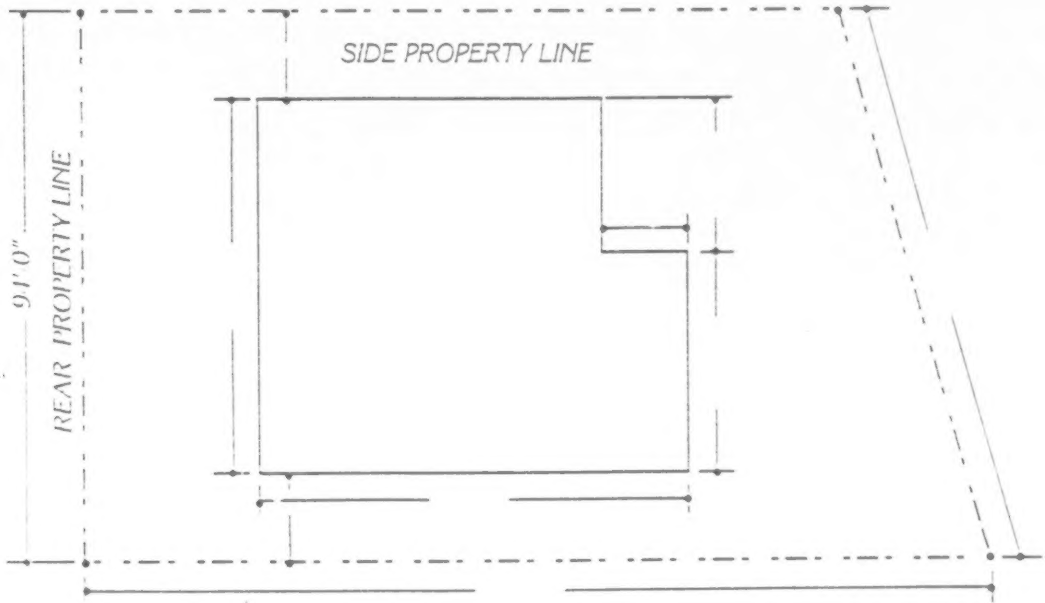
NOTE: Accuracy may vary because of distortion due to the plan reproduction process.

Data Analysis and Display Skills
- Interpret graphs

Job Acquisition/Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

Part 1

Use an engineer's scale to find the dimensions on the plot plan below. Write your answers on each of the dimension lines.

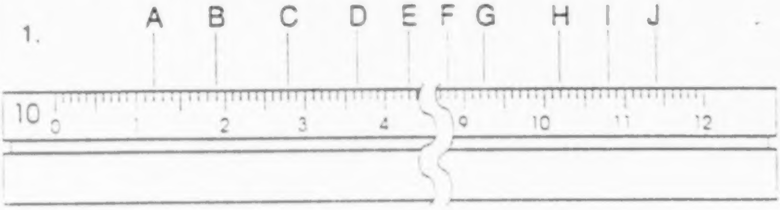

SIDE PROPERTY LINE
REAR PROPERTY LINE
91'0"

SCALE: 1" = 30'-0"

Part 2

Read the following scales from zero to the letter points indicated. Write the correct readings in the blanks below the scales.

1.


A
B
C
D
E
F
G
H
I
J
10
0
1
2
3
4
9
10
11
12

A = ________________

B = ________________

C = ________________

D = ________________

E = ________________

F = ________________

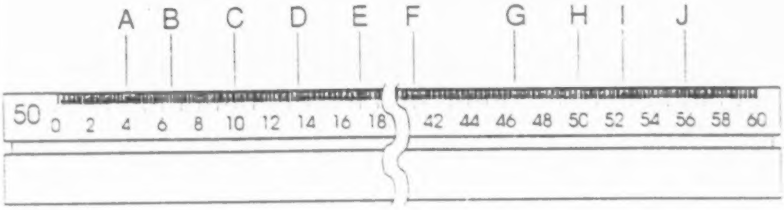
G = ________________

H = ________________

I = ________________

J = ________________

2.


A
B
C
D
E
F
G
H
I
J
50
0
2
4
6
8
10
12
14
16
18
42
44
46
48
50
52
54
56
58
60

A = ________________

B = ________________

C = ________________

D = ________________

E = ________________

F = ________________

G = ________________

H = ________________

I = ________________

J = ________________

ASSIGNMENT SHEET

Section A: Architect's Scale

Part 1

NOTE: Answers may vary due to printing distortions.

1. 11′-3″
2. 8′-1″
3. 3′-4″
4. 1′-11″
5. 3′-8″

Part 2

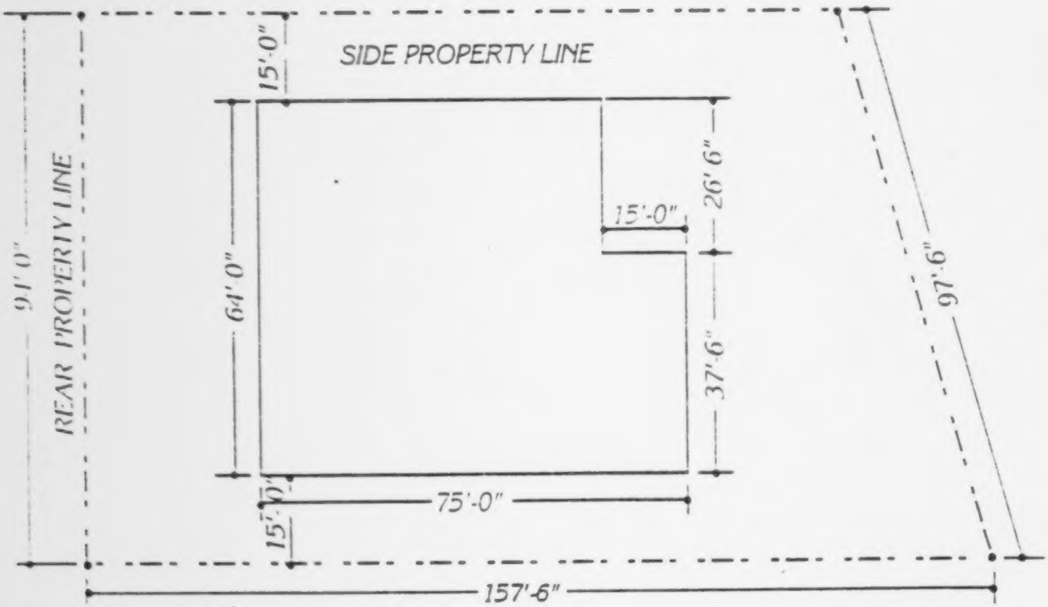
1. A. 2′-0″
   B. 1′-6″
   C. 1′-0″
   D. 1″
   E. 1⅝″
   F. 3″
   G. 4⅞″
   H. 6¼″
   I. 7¼″
   J. 8⅞″
   K. 9½″
   L. 11″
2. A. 7′-0″
   B. 6′-6″
   C. 5′-0″
   D. 4′-0″
   E. 2′-0″
   F. 6″
   G. ½″
   H. 2″
   I. 6″
   J. 10½″

3. A. 15'-6"
B. 13'-6"
C. 13'-0"
D. 11'-0"
E. 9'-6"
F. 7'-0"
G. 4'-6"
H. 2'-6"
I. 1'-6"
J. 3"

4. A. 2'-0"
B. 5'-0"
C. 7'-0"
D. 9'-0"
E. 12'0"
F. 14'-0"
G. 18'-0"
H. 22'-0"
I. 25'-0"
J. 28'-0"

Section B: Engineer's Scale

Part 1


SIDE PROPERTY LINE
REAR PROPERTY LINE
15'-0"
91'-0"
64'-0"
26'-6"
15'-0"
37'-6"
97'-6"
75'-0"
15'-0"
157'-6"

SCALE: 1" = 30'-0"

Part 2

1. A. 12'-0"
   B. 19'-0"
   C. 28'-0"
   D. 36'-6"
   E. 43'-0"
   F. 88'-0"
   G. 92'-6"
   H. 102'-0"
   I. 108'-0"
   J. 114'-0"

2. A. 40'-0"
   B. 65'-0"
   C. 100'-0"
   D. 135'-0"
   E. 170'-0"
   F. 410'-0"
   G. 465'-0"
   H. 500'-0"
   I. 525'-0"
   J. 560'-0"

WRITTEN TEST

PLAN READING

C 2

Name ______________________ Score ________

OBJECTIVE 1

Given a list of architectural terms associated with plan reading, match them to their correct definitions. Write the letter that corresponds to the most correct answer.

_____ 1. A set of detailed working drawings or plans drawn to scale is called a/an ______________.

a. scaled version
b. structure perspective
c. information drawing
d. architect's drawing

_____ 2. A 2×4 board is actually only 1½ × 3½ inches; this smaller size is called the ______________.

a. actual dimension
b. seasoned dimension
c. wet dimension
d. construction size

_____ 3. What term is used to describe an architect's standard method to represent dimensions and structural details on blueprints?

a. convention
b. standard labeling
c. elevation
d. scaling

_____ 4. Which of the following terms best describe lines used on plot plans to show both natural grade and finish grade elevations?

a. grade lines
b. dimension lines
c. contour lines
d. elevation grads

May be photocopied for student use.

votech

_____ 5. What is the term used to describe a document to list the parts, amounts, materials or products, and details concerning a construction project?

a. Fact sheet
b. Finish schedule
c. Bill of material
d. Parts list

_____ 6. The _______________ are a set of detailed written instructions that supplements the set of plans and describes equipment and material to be used in the structure.

a. finish plans
b. perspective
c. scaled version
d. specifications

_____ 7. Which term best describes the reproductions of an architect's drawings?

a. Copy version
b. Blueprints
c. Draft plans
d. Originals

OBJECTIVE 2 **Given alternatives, match each document within a set of building plans to its purpose.**

_____ 1. What is the purpose of a floor plan?

a. To show a horizontal view of a building
b. To show a vertical view of a building
c. To show the support members beneath the flooring
d. All of the above

May be photocopied for student use.

_____ 2. A plan that shows the horizontal view, where the building is to be located on a site, is called a/an _______________.

a. section plan
b. foundation plan
c. plot plan
d. elevation plan

_____ 3. A cut-away vertical view through an object or wall to show its interior makeup is called a/an _______________.

a. section view
b. detail view
c. expanded view
d. zoomed drawing

_____ 4. What is the term that represents a horizontal view of an entire masonry substructure below the first floor or frame of a building?

a. Detail view
b. Foundation plan
c. Floor plan
d. Basement detail

_____ 5. A written description of work to be done is called the _______________.

a. detail list
b. drawings
c. plot plan
d. specifications

_____ 6. What is the best term to describe a larger scale graphic to represent special features of a structure that has already been shown in another drawing?

a. expanded view
b. detail drawing
c. blown-up feature
d. zoomed drawing

May be photocopied for student use.

OBJECTIVE 3 **Choose the proper definitions for types of architectural lines.**

_____ 1. An object line is used to

a. show the main outline of a structure
b. indicate dimensions
c. indicate the center of a structure
d. show lines that are not visible

_____ 2. A section line shows

a. the center of a structure
b. the main outline
c. a cut-away view
d. area dimensions

NOTE: Objective 4 is evaluated on an assignment sheet in this unit. If you have not completed this component, see your instructor.

May be photocopied for student use.

WRITTEN TEST ANSWERS

PLAN READING

C 2

OBJECTIVE 1

1. d
2. a
3. a
4. c
5. b
6. d
7. b

OBJECTIVE 2

1. a
2. c
3. a
4. b
5. d
6. b

OBJECTIVE 3

1. a
2. c

OBJECTIVE SHEET

SITE LAYOUT

C 3

INTRODUCTION

It is very important to know local regulations, covenants, restrictions, and zoning laws prior to laying out a project. Knowing these laws could save time, money and possible lawsuits. Accuracy is also essential in site layouts. The cost of redoing or making architectural changes may be prohibitive or unacceptable.

UNIT OBJECTIVE

After completing this unit, the student will be able to erect batter boards, locate building lines, lay out footings, square building lines, and set grade stakes. The student will show this knowledge by completing the Assignment Sheet, Job Sheets, and Written Test with a minimum score of 85 percent.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to:

1. Given a list of alternative, match terms associated with site layout to their correct definitions.
2. Choose the correct definitions for terms associated with grades and leveling instruments.
3. Select from a list, factors pertinent to site layout.
4. Given choices, pick the correct considerations used in laying out building lines.
5. From a list, differentiate the purpose of batter boards.
6. Given the name of the method, distinguish between proper and improper procedures used to square building lines.
7. Write layout dimensions on a plot plan. (Assignment Sheet)
8. Erect batter boards and locate building lines for a structure. (Job Sheet 1)
9. Lay out footings for a structure. (Job Sheet 2)
10. Set grade stakes for footings without forms. (Job Sheet 3)

PREPARATION

- Review unit and plan presentation.
- Obtain materials to supplement unit.

  EXAMPLES: Set of local regulations, covenants, and zoning laws. Appropriate site-layout, instrument and rod. Equipment and materials necessary for students to complete Job Sheets. Samples of plot plans.

- Make arrangements for a field trip to a construction site.
- Invite a surveyor or engineer to speak to the students about layout work.
- Invite a utility company representative to discuss locating utilities and to relate case studies of problems that have been encountered.
- Supply guest speakers with specific objectives and other appropriate sections of the unit.

DELIVERY

Objective 1: Given a list of alternatives, match terms associated with layout to their correct definitions.

- Discuss terms and definitions associated with site layout.
- Show students examples to illustrate appropriate terms.
- Review units titled "Measuring" and "Plan Reading."
- Explain that an understanding of terms related to site layout is essential for reading and understanding plans and covenants.
- Explain that commonality of term meaning is required for communication with workers within the trade and with workers from related trades employed on the job site.

Objective 2: Choose the correct definitions for terms associated with grades and leveling instruments.

- Discuss terms and definitions pertaining to grades and leveling instruments.
- Take students on a field trip to a construction site on which workers are laying out a building.
- Have an open quiz by asking for the definition of each term or by giving the definition and asking for the appropriate term.
- Show students examples of appropriate terms.

Objective 3: Select from a list, factors pertinent to site layout.

- Discuss factors pertinent to site layout.
- Hand out copies of local regulations, covenants and zoning laws for a construction project. Have students read covenants and locate particulars. Discuss and answer questions as they arise.

Objective 4: Given choices, pick the correct considerations used in laying out building lines.

- Discuss information used to lay out building lines.
- Provide students with various plot plans and use the Transparency to illustrate information related to laying out building lines.
- Have students practice recognizing layout dimensions on sample plot plans.

Objective 5: From a list, differentiate the purpose of batter boards.

- Discuss the purpose of batter boards.

Objective 6: Given the name of the method, distinguish between proper and improper procedures used to square building lines.

- Discuss methods used to square building lines.
- Have students use stakes and strings to practice squaring corners. Practice could be done inside using chalk and string if the weather is inclement.
- Set up a contest to see who can correctly lay out building lines, maintain square, and shoot correct grades most quickly or efficiently.

APPLICATION

Objective 7: Write layout dimensions on a plot plan. (Assignment Sheet)

- Use Assignment Sheet to give students practice in laying out dimensions on plot plans.

Objective 8: Erect batter boards and locate building lines for a structure. (Job Sheet 1)

Objective 9: Lay out footings for a structure. (Job Sheet 2)

Objective 10: Set grade stakes for footings without forms. (Job Sheet 3)

- Job Sheets 1 and 2 can be utilized as a class project and individuals evaluated at the discretion of the instructor.

EVALUATION

Pretest

- Give written test as pretest.
- Determine individual study requirements from pretest results.
- Counsel students individually on pretest results and study requirements.
- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.
- Evaluate students on job sheet activities.
- Complete appropriate section of competency profiles.
- Reteach and reevaluate if necessary.
- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the Written test actions listed in the specific objectives.

  NOTE: The written test may be given in sections if desired.

- Give Written Test.
- Complete appropriate sections of competency profiles.
- Reteach and retest if necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

UNIT REFERENCES

- Toenjes, Leonard P. *Building Trades Dictionary*. Homewood, Illinois: American Technical Publishers, Inc., 1989.
- Wagner, Willis H. *Modern Carpentry*. South Holland, Illinois: The Goodheart-Willcox Co., Inc., 1987.
- Willey, Al. *Fundamentals of Carpentry*. Oklahoma Department of Vocational and Technical Education Curriculum and Instructional Materials Center and the Associated General Contractors of America: Stillwater, OK, 1993.

OBJECTIVE 1

Given a list of alternatives, match terms associated with site layout to their correct definitions.

- **batter board** — temporary framework on which to stretch a line to assist in locating corners and building lines when laying out a building (Figures 1 and 2)

  EXAMPLES:

FIGURE 1

Straight batter board

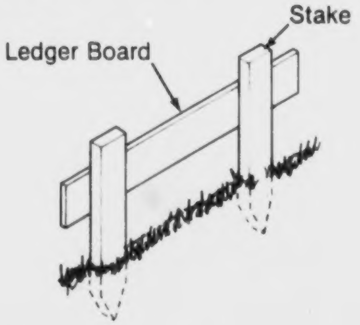
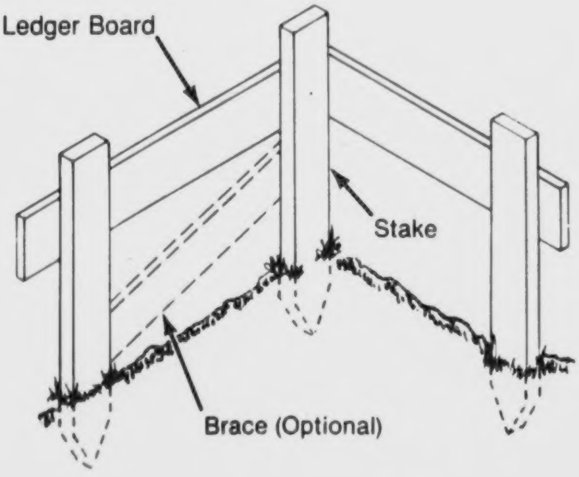

Stake
Ledger Board

FIGURE 2

Right angle batter board


Ledger Board
Stake
Brace (Optional)

- **building permit** — agreement between builder and city that specifies the type, quality, and extent of construction on structure to be erected
- **easement** — a vested or acquired right to use land, other than as a tenant, for a specific purpose; such right being held by someone other than the owner who holds the title to the land
- **excavating** — removing soil for footing or for establishing a uniform grade
- **kerf** — slight indentation made with a saw; used to hold line in place
- **ledger board** — top horizontal board on batter board framework
- **plot plan** — horizontal view showing where the building is to be located on the site
- **plumb bob** — tool or device attached to a string; used to set or check plumb or perpendicular/vertical alignment
- **plumb down** — to plumb from a given point down to a point below
- **property lines** — boundaries of a lot or plot of ground
- **setback line** — line established by law, fixing exterior face of structure a minimum distance from right-of-way or property line
- **surveying** — art or science of determining the area and configuration of portions of the earth's surface

OBJECTIVE 2

Choose the correct definitions for terms associated with grades and leveling instruments.

- **bench mark (BM)** — permanent point of known or assumed elevation

  NOTE: A specific point on a curb, culvert, or other permanent object is sometimes used.

- **builder's level** — instrument consisting of a telescope, leveling bubble, and tripod; used primarily for establishing grade levels

- **elevation** — given grade

- **fall** — the slope of a line, such as inches of fall per foot of run

  EXAMPLE: 1 inch fall per 1 foot of run

- **fill** — soil or other substance used to establish existing grade

- **finish-floor grade** — elevation of finished floor in relation to bench mark

- **grade line** — proposed or future level of ground around structure

- **grade stake** — stake driven into ground, usually with top establishing finished level of ground or concrete at that point

  NOTE: Grade for the stake is read from the bench mark.

- **height of instrument (HI)** — vertical distance from bench mark to line of sight of instrument

- **leveling rod** — rod used with builder's level; graduated in tenths and hundredths of a foot or in inches and feet

- **transit** — surveying instrument consisting of a telescope, leveling bubble, leveling head, and tripod; used primarily to establish angles and straight lines

OBJECTIVE 3 **Select from a list, factors pertinent to site layout.**

- Local regulations and covenants (zoning and restrictions)

  EXAMPLES: Setback line; proximity to side property lines; elevation, size, shape, and proximity to surrounding buildings and areas

- Location of utilities

  EXAMPLES: Electricity, sewers, gas, phone

- Presence of existing trees and shrubs
- Contour or shape of site

  EXAMPLES: Flat, rolling, sloping

- Characteristics of soil
- Orientation of site

  EXAMPLES: Relationship to other sites; north, east, south, and west boundaries; wind direction; solar energy-utilization possibilities, scenery

OBJECTIVE 4 **Given choices, pick the correct considerations used in laying out building lines.**

- Dimensions of property
- Setback from curb
- Setback from sidewalk
- Setback from property lines
- Distance from side boundaries
- Distance from rear property line
- Location and dimensions of easement(s)
- Dimensions (length and width) of building
- Orientation of building on lot (square or diagonal)
- Location of bench mark and grade

  NOTE: These considerations will be made and documented on the plot plan.

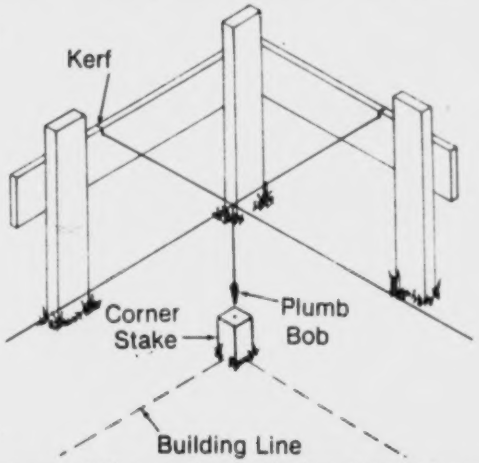
OBJECTIVE 5 **From a list, differentiate the purposes of batter boards.**

- To provide a place for stretching a line used to establish building lines for excavation and construction

  NOTE: Steel stakes are sometimes used in place of batter boards.

  EXAMPLE: Using batter boards to set up building lines

FIGURE 3



OBJECTIVE 6 **Given the name of the method, distinguish between proper and improper procedures used to square building lines.**

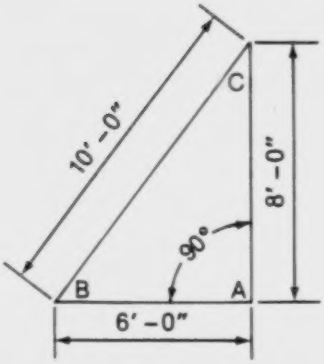
- **3-4-5 method** — Form a right triangle using largest multiple of

  3-4-5 possible for length of lines being squared, and ensure that longest side of triangle is exact appropriate multiple of 5

  NOTE: Any multiple of 3-4-5 may be used [i.e., 6-8-10, 12-16-20, 24-32-40] depending on the size being checked.

  EXAMPLE: Using 3-4-5 rule to square building lines 6′-0″ × 8′-0″, line BC will measure exactly 10 feet if lines AB and AC are square. (Figure 4)

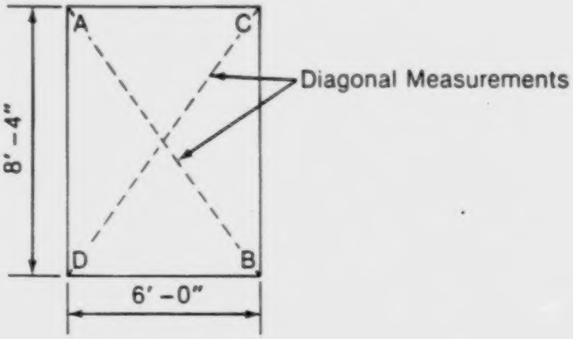
FIGURE 4


10'-0"
C
8'-0"
90°
B
A
6'-0"

- **diagonal method** — Measure diagonally from inside corners of layout and ensure that diagonal lines are equal in length

EXAMPLE: Using the diagonal method to square building lines 6'-0" × 8'-4", lines AB and CD will be exactly the same measurement if building corners are square and if dimensions on opposite sides are exactly the same as each other. (Figure 5)

FIGURE 5

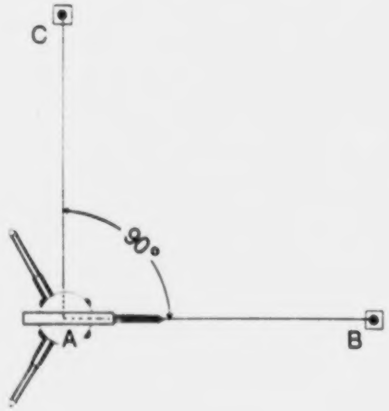

A
C
Diagonal Measurements
8'-4"
D
B
6'-0"

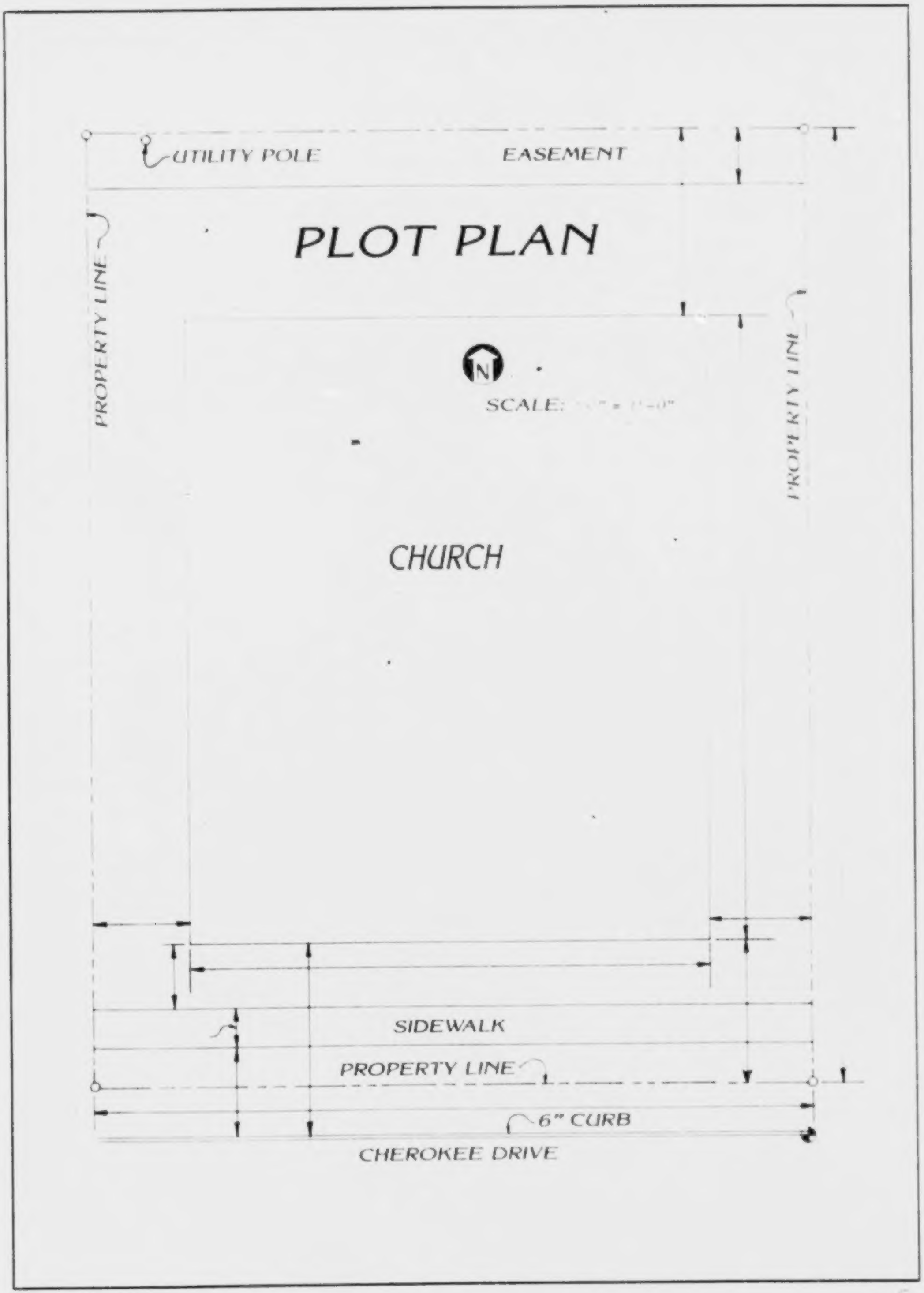
402

- **transit method** — Set the instrument exactly at point where right angle is to be, sight a reference point on one line of angle, set 360-degree scale at zero, and establish second line of angle where scale indicates a 90-degree arc has been completed

  EXAMPLE: Using instrument to square corners of building lines, when instrument is at point A and sighted on a point on line AB, 360-degree scale will indicate that an arc of 90 degrees has been completed at line AC. (Figure 6)

FIGURE 6




UTILITY POLE
EASEMENT
PLOT PLAN
PROPERTY LINE
PROPERTY LINE
N
SCALE: [illegible]" = 1'-0"
CHURCH
SIDEWALK
PROPERTY LINE
6" CURB
CHEROKEE DRIVE

ASSIGNMENT SHEET

SITE LAYOUT C 3

Name ______________________ Score ________

OBJECTIVE 7

Write layout dimensions on a plot plan.

INTRODUCTION

In order to be able to lay out a building site correctly, you must be able to read dimensions on a plot plan.

INSTRUCTIONS

Review the Information Sheet, and then write the dimensions below in the correct places on the plot plan on the following page.

Functional Reading Skills
- Follow written instructions
- Interpret abbreviations/acronyms

Data Analysis and Display Skills
- Interpret plans/blueprints

Functional Math Skills
- Solve practical problems

Property dimensions

- Front — 75′-0″
- Rear — 75′-0″
- East side — 99′-6″
- West side — 99′-6″

Building size — 65′-0″ × 54′-0″

NOTE: Building should be parallel with boundary lines.

Bench mark — 100′-0″

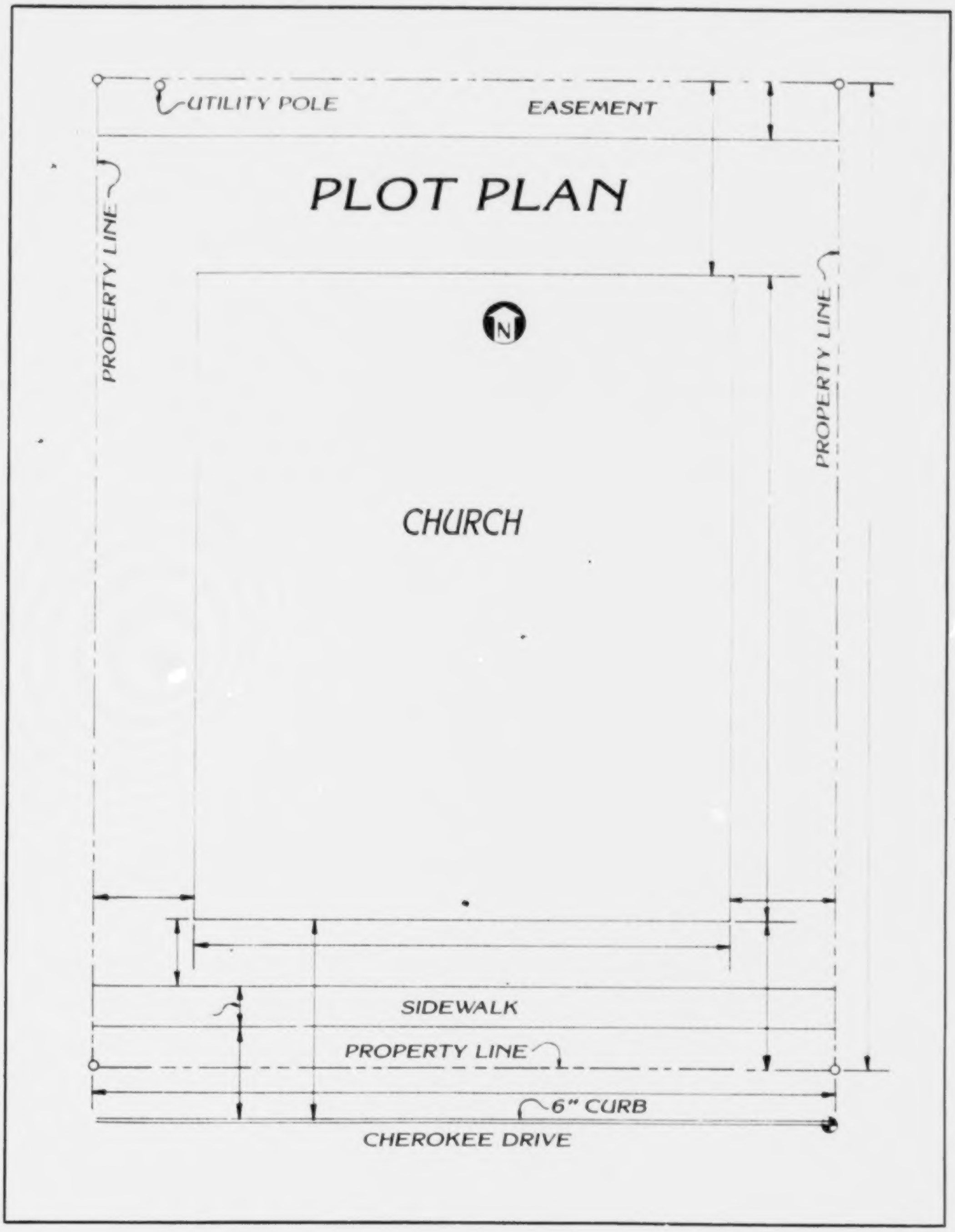
Easement — 5′-11″ at rear of property

Sidewalk

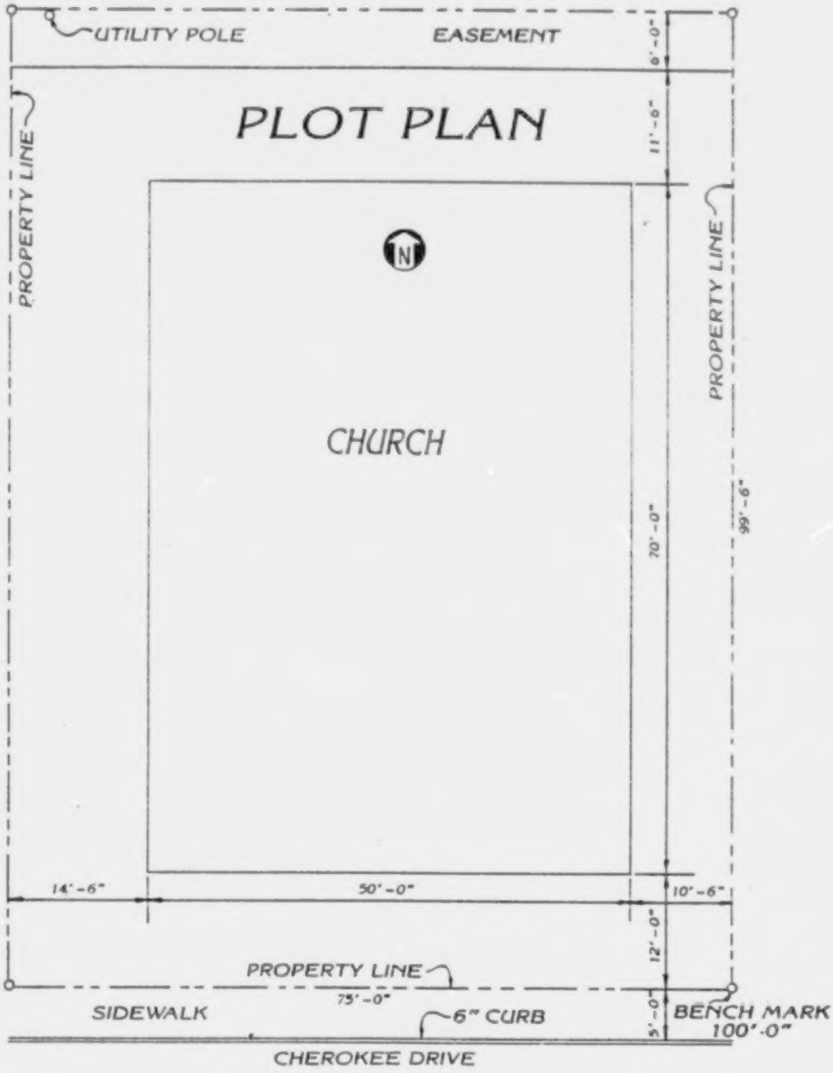
- 4′-0″ wide
- 6′-10″ from building

Setbacks

- 20′-5″ from center of curb
- 15′-0″ from south property line
- 10′-2″ from west property line
- 10′-10″ from east property line
- 19′-6″ from north property line


UTILITY POLE
EASEMENT
PLOT PLAN
PROPERTY LINE
PROPERTY LINE
N
CHURCH
SIDEWALK
PROPERTY LINE
6" CURB
CHEROKEE DRIVE

ASSIGNMENT SHEET


UTILITY POLE
EASEMENT
6'-0"
PLOT PLAN
11'-6"
PROPERTY LINE
PROPERTY LINE
N
CHURCH
70'-0"
99'-6"
14'-6"
50'-0"
10'-6"
12'-0"
PROPERTY LINE
75'-0"
SIDEWALK
6" CURB
5'-0"
BENCH MARK
100'-0"
CHEROKEE DRIVE

JOB SHEET 1 SITE LAYOUT C 3

OBJECTIVE 8

Erect batter boards and locate building lines for a structure.

INTRODUCTION

Establishing the building and property lines is the first critical step before construction can begin. Ensure that you discuss this issue carefully with your supervisor or instructor.

TOOLS AND MATERIALS

- Hard hat and goggles
- Sledgehammer
- Claw hammer
- Crosscut hand saw
- Circular saw and extension cord
- Builder's level, transit and rod
- String line
- Rule and tapes
- Pencil
- Plot plan
- Batter board stakes, 2 × 4's
- Ledger boards, 1 × 6's
- Braces, 1 × 4's
- Corner stakes, 2 × 2's
- 8 d box nails

NOTE: The plot plan is provided at the end of this unit.

PROCEDURE

Reading Comprehension Skills
- Gain factual information

Yes No

NOTE: The procedure outlined in this job sheet is just one of several acceptable methods.

1. Put on safety equipment ___ ___
2. Cut material to size.
   - Cut batter board stakes to dimensions and configurations shown in Figure 7. ___ ___

Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

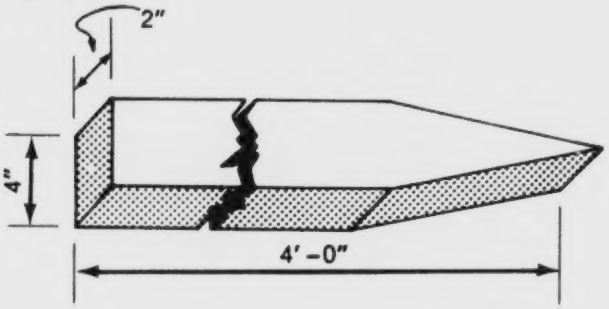
Math Application Skills
- Apply geometry principles

General Science Skills
- Use scientific instruments

Job Acquisition/ Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

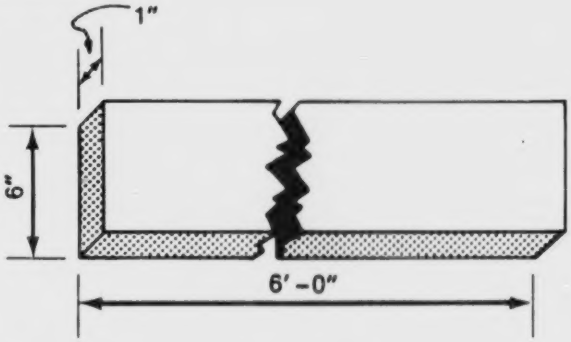
Yes No

FIGURE 7



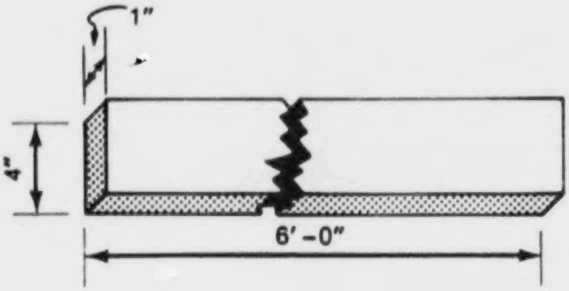
- Cut ledger boards. (Figure 8) ___ ___

FIGURE 8



- Cut braces. (Figure 9) ___ ___

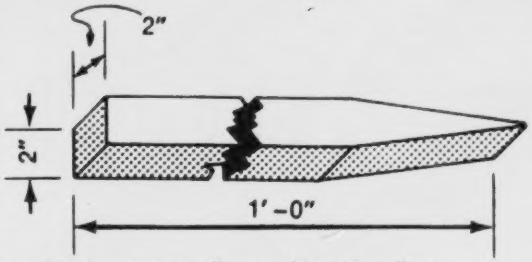
FIGURE 9



Yes No

- Cut corner stakes to dimensions and configurations shown in Figure 10. ___ ___

FIGURE 10



3. Mark property lines with string line.

   a. Locate surveyor's pins marking four corners of property. ___ ___

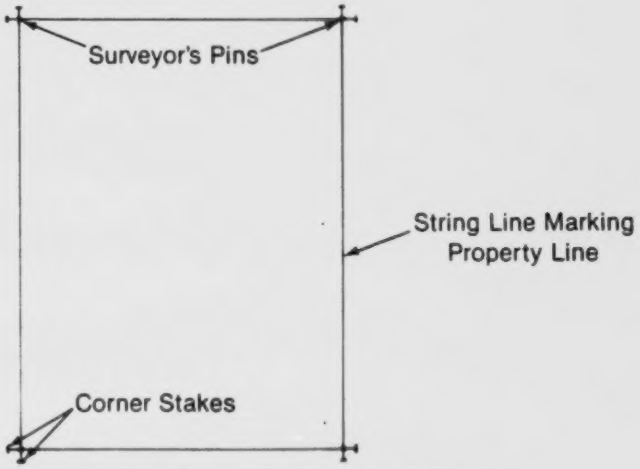
   b. Set corner stakes beside surveyor's pins. (See Figure 11) ___ ___

   c. Attach string line to corner stakes. (Figure 11) ___ ___

   NOTE: Leave property string line in place until exact building lines have been established.

Yes No

FIGURE 11


Surveyor's Pins
String Line Marking Property Line
Corner Stakes

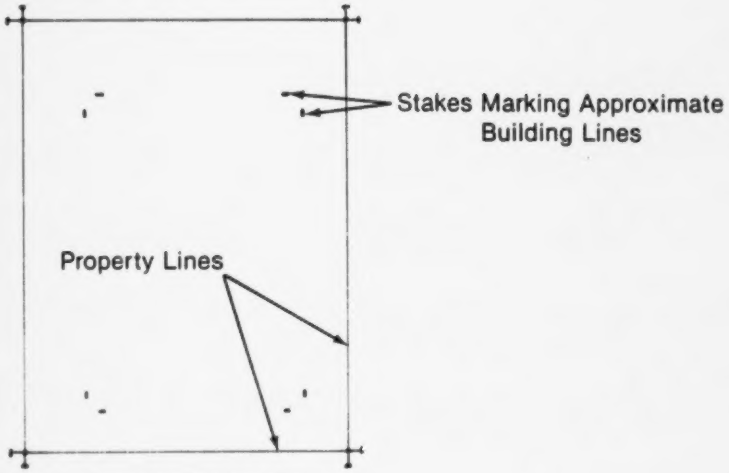
4. Mark approximate location of building lines with string line.

   a. Using property lines and plot plan as reference, measure to determine approximate location of building lines; mark approximate building lines by driving at least two stakes along each line. (Figure 12) — —

      NOTE: Nails or other temporary markers may be used to mark these lines.

Yes No

FIGURE 12


Stakes Marking Approximate Building Lines
Property Lines

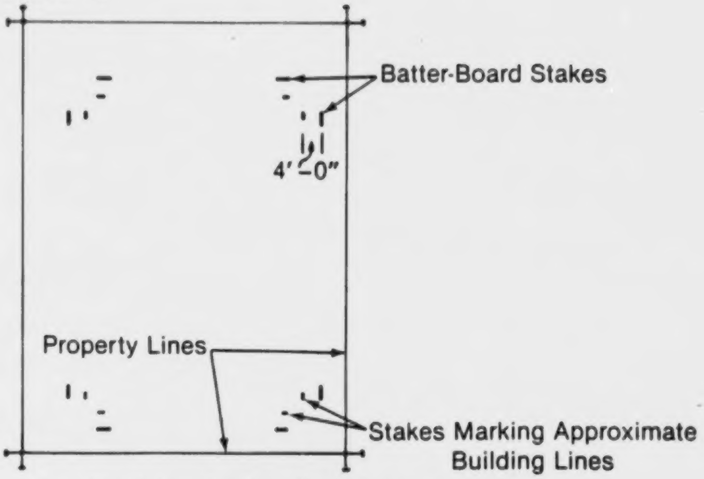
b. Erect batter boards. ___ ___

c. Measure a point at least 4 feet behind each stake marking approximate building lines; drive a batter board stake at each point. (Figure 13) ___ ___

NOTE: When setting batter board stakes for large structures, set stakes at least 20 feet outside approximate building lines to leave work room for heavy equipment.

Yes No

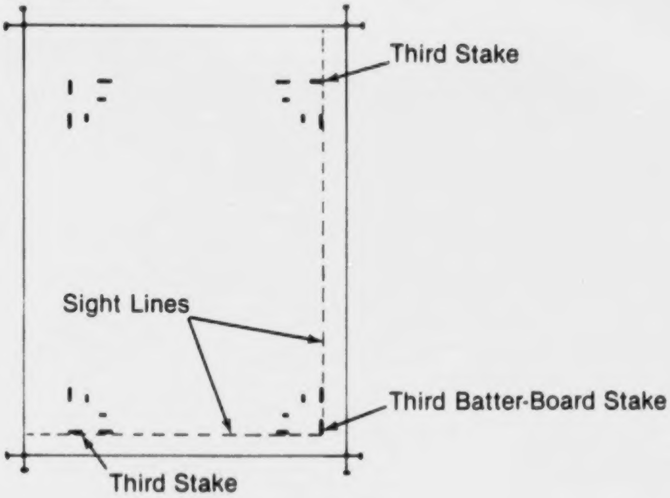
FIGURE 13



Batter-Board Stakes
4'-0"
Property Lines
Stakes Marking Approximate Building Lines

d. To determine location of corner stake for each batter board, sight a line parallel to two batter board stakes on each line of angle; drive third batter board stake where two lines intersect. (Figure 14) ___ ___

FIGURE 14



Third Stake
Sight Lines
Third Batter-Board Stake
Third Stake

Yes No

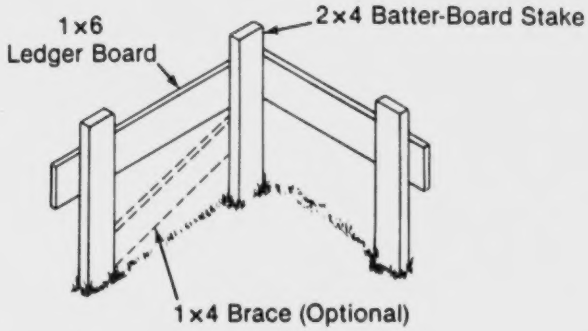
e. Use builder's level to establish elevation on each batter board stake. ___ ___

f. Nail ledger boards at correct elevation on batter board stakes. (Figure 15) ___ ___

g. Nail braces to batter board stakes if necessary. (Figure 15) ___ ___

NOTE: Braces are used when the soil is loose or when the batter board stakes must be taller than 3 feet. ___ ___

FIGURE 15

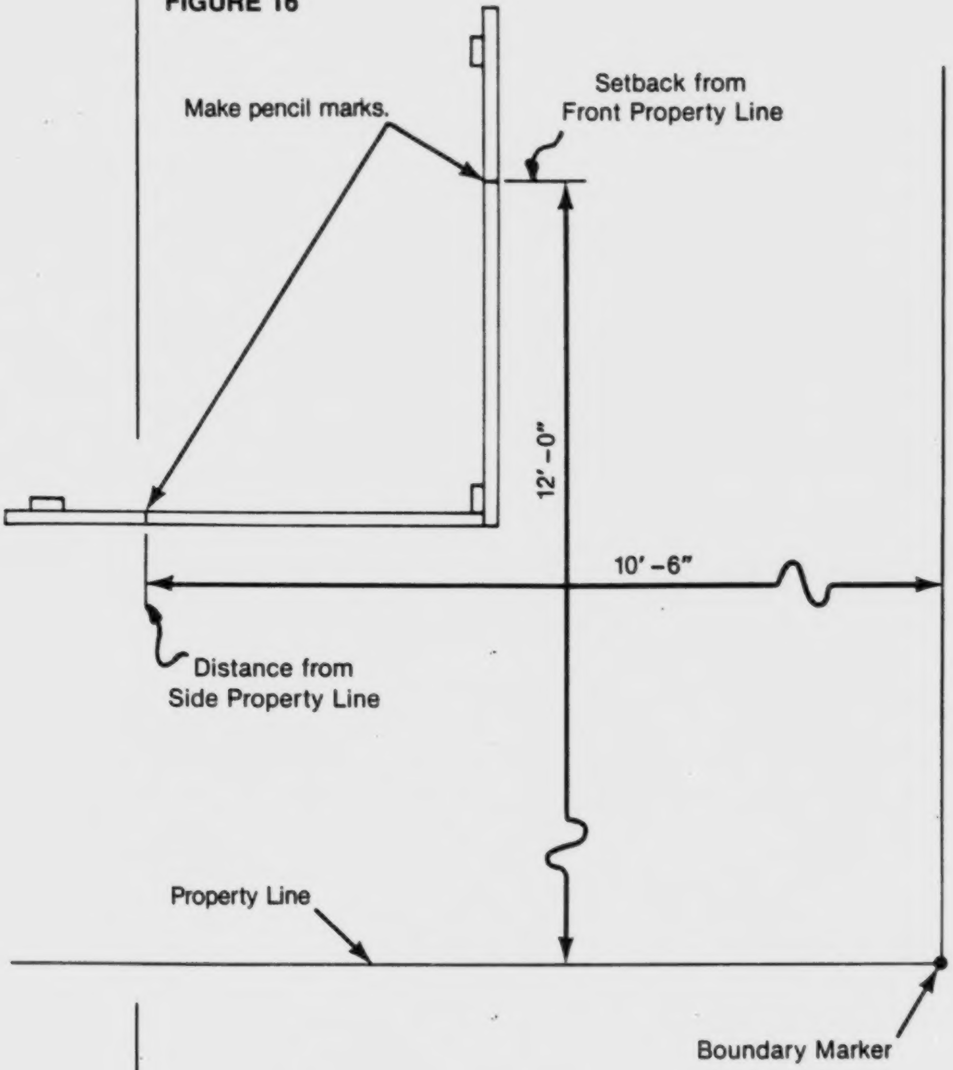


5. Mark permanent building lines with string line.

    a. Measure from property lines to ledger boards; make pencil mark on top of ledger boards. (Figure 16) ___ ___

Yes No

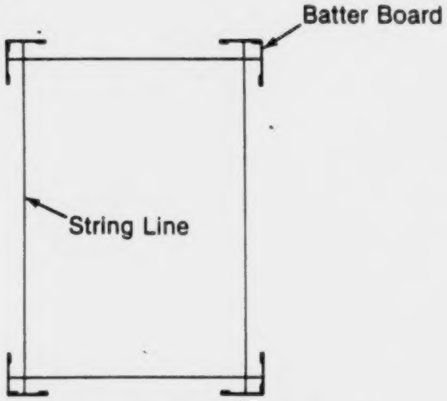
FIGURE 16


Make pencil marks.
Setback from Front Property Line
12'-0"
10'-6"
Distance from Side Property Line
Property Line
Boundary Marker

b. Drive nails at pencil marks on ledger boards; attach string lines to nails and stretch as shown in Figure 17. ___ ___

Yes No

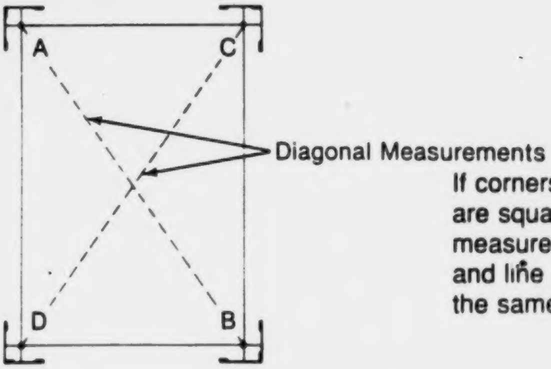
FIGURE 17


Batter Board
String Line

c. Check squareness of corners by using diagonal method (Figure 18), 3-4-5 method (Figure 19), or transit method (Figure 20), and adjust string lines as necessary ___ ___

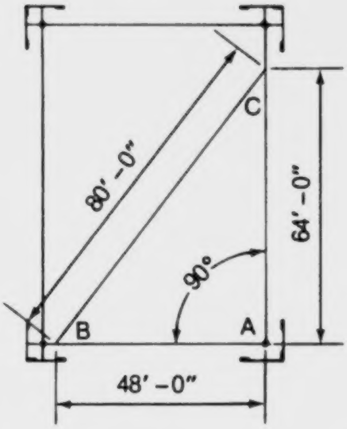
FIGURE 18

Diagonal Method


A
C
D
B
Diagonal Measurements

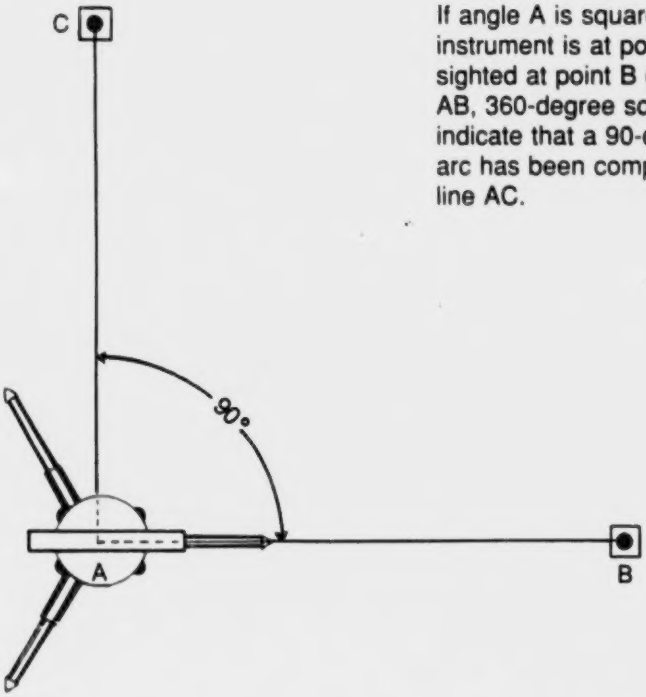
If corners of building lines are square, both diagonal measurements (line AB and line CD) will be exactly the same.

FIGURE 19: 3-4-5 Method



If angle A is square and measurements are exact, line BC will measure exactly 80 feet (using the 48-64-80 multiple of 3-4-5).

FIGURE 20: Transit Method

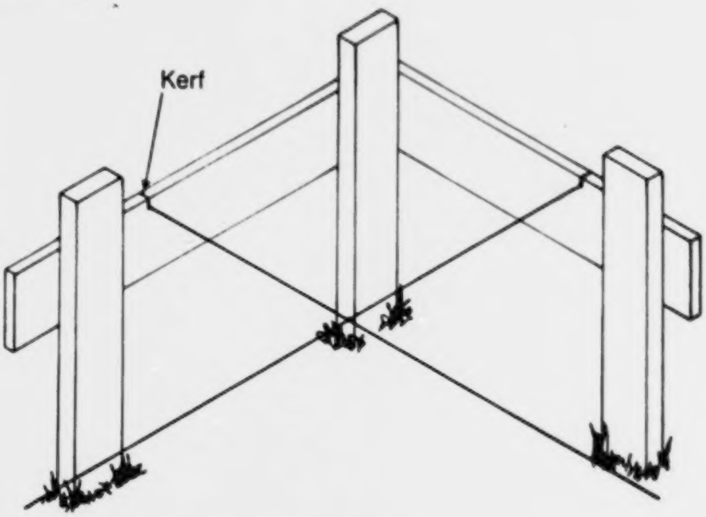


If angle A is square, when instrument is at point A and sighted at point B on line AB, 360-degree scale will indicate that a 90-degree arc has been completed at line AC.

Yes No

d. After corners have been squared, saw kerf in ledger boards at exact squared location; attach string to kerf to keep string from shifting. (Figure 21) ___ ___

FIGURE 21



6. Clean work area; clean and store tools and materials properly. ___ ___

(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Batter boards correct and solid	4	3	2	1
Layout on batter boards are correct	4	3	2	1
Corners of building lines are square	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** Can perform job with no additional training
3 **Moderately Skilled** Has performed job during training program; limited additional training may be required
2 **Limited Skill** Has performed job during training program; additional training is required to develop skill
1 **Unskilled** Is familiar with process, but is unable to perform job

JOB SHEET 2 SITE LAYOUT C 3

OBJECTIVE 9 **Lay out footings for a structure.**

INTRODUCTION This exercise allows you to practice procedures to prepare a site to pour a concrete footing.

TOOLS AND MATERIALS

- Hard hat and goggles
- Foundation plan
- Sledge hammer
- Claw hammer
- Crosscut hand saw
- Circular saw and extension cord
- Folding rule or metal tape
- Builder's level and rod
- Plumb bob
- String line
- Pencil
- Corner stakes, 2″ × 2″ × 12″
- Footing-line stakes, 2 × 4″ × 18″
- 8 d box nails
- Form boards
- Material for spreader boards

NOTE: The foundation plan and floor plan are provided at the end of this unit.

PROCEDURE

Reading Comprehension Skills
- Gain factual information

	Yes	No
1. Put on hard hat and goggles	___	___
2. Locate building lines. (Job Sheet 1)	___	___

Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

Math Application Skills
- Apply geometry principles

General Science Skills
- Use scientific instruments

Job Acquisition/ Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

Yes No

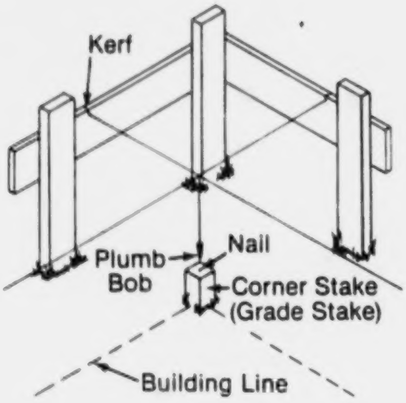
3. Locate and drive grade stakes

   a. Plumb down from intersection of string lines marking each corner of building lines; drive corner stakes (grade stakes) at these points. (Figure 22) ___ ___

   b. Use builder's level to establish grade. ___ ___

   c. Drive nail in top of each grade stake to locate exact point of intersection. (Figure 22) ___ ___

FIGURE 22



   d. Remove plumb bob. ___ ___

Yes No

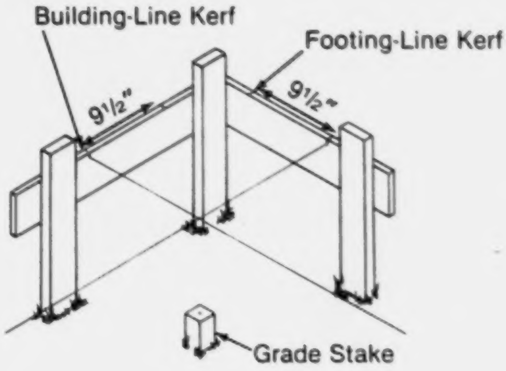
4. Establish footing lines on batter boards.

   a. Determine from foundation plan and floor plan how far outside of building lines the footing forms will extend. ___ ___

      NOTE: Since footings are 2 feet wide and the finished walls are 8 inches thick, the footing lines will have to be set 8 inches both ways from the building lines, and another 1½ inches will have to be added to allow for the thickness of the forms on each side.

   b. Measure over 9½ inches from building-line kerf; mark this measurement on top of batter boards, and saw kerf on this mark. (Figure 23) ___ ___

FIGURE 23



Yes No

c. Drive a nail into ledger board at kerf. ___ ___

NOTE: The nail at this point will help distinguish footing line from building line.

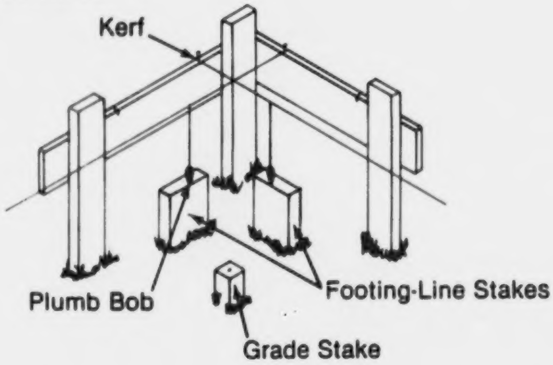
d. Perform this procedure on all batter boards. ___ ___

e. Move string line from building-line kerfs to footing-line nails and stretch from one footing-line nail to the next, continuing around proposed structure. ___ ___

5. Set form stakes..

a. Use plumb bob to locate position of footing-line stakes at each corner of proposed structure. (Figure 24) ___ ___

FIGURE 24

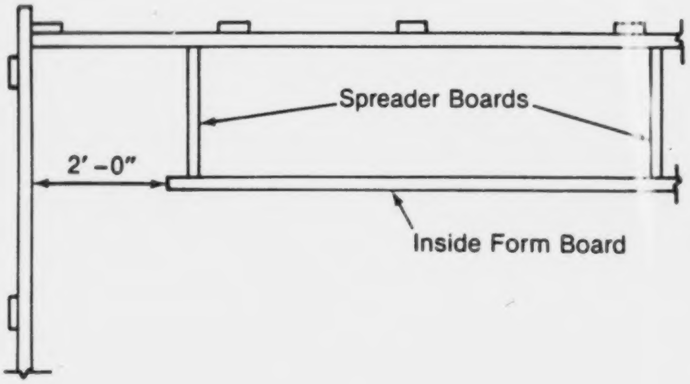


b. Transfer grade from grade stakes to footing-line stakes. ___ ___

c. Remove grade stakes. ___ ___

	Yes	No
d. Attach string line to stakes; stretch the line tightly from one footing-line stake to the one on opposite end of footing; center the line on the grade that was transferred to those stakes.	___	___
e. Lay out form boards along the footing line.	___	___
f. Set stakes approximately every 4 feet, and nail form boards on grade to these stakes to establish the outside forms.	___	___
g. Cut two spreader boards 2 feet long and place against outside forms; set inside form board against these spreaders. (Figure 25).	___	___

FIGURE 25



Yes No

h. Set stakes for inside form. ___ ___

NOTE: When driving stakes against inside form, drive stakes straight down so that there is no force against the form, which would tend to move the outside form out of line.

i. Continue setting stakes and nailing forms to grade until all forms are set. ___ ___

NOTE: Alignment of forms can be checked by using the plumb bob attached to the string line.

6. Clean work area; clean and store tools and materials properly. ___ ___

(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS ______________________________

____

____

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PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Footing forms are straight and solid	4	3	2	1
Forms are correct distance apart	4	3	2	1
Forms are on grade	4	3	2	1

NOTE: This job sheet is a class activity and no time limit is established.

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** – Can perform job with no additional training
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill
1 **Unskilled** – Is familiar with process, but is unable to perform job

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OBJECTIVE 10 **Set grade stakes for footings without forms.**

INTRODUCTION During these procedures, the student will practice using a foundation plan and a builder's level to set the grade of a footing.

TOOLS AND MATERIALS

- Hard hat and goggles
- Foundation plan (Supplement)
- Sledgehammer
- Builders level and rod
- Folding rule or metal tape
- 30 each — 18-inch-long reinforcing bars (rebars) to use as grade stakes

NOTE: 2 × 4 or 1 × 4 stakes could also be used as grade stakes.

PROCEDURE

Reading Comprehension Skills
- Gain factual information

Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

	Yes	No
NOTE: After footings have been excavated, it is necessary to set grade stakes for concrete.		
1. Put on hard hat and goggles.	___	___
2. In the center of the footing excavation, drive stakes every 8 feet to 10 feet.	___	___
3. Set each stake at grade.		
a. While an assistant shoots grade with builder's level, hold rod on top of stake.	___	___

Math Application Skills
- Apply geometry principles

General Science Skills
- Use scientific instruments

Job Acquisition/ Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

	Yes	No
b. Remove rod and drive stake with sledgehammer until top of stake is approximately on grade.	__	__
c. Hold rod on top of stake and check grade.	__	__
d. Continue driving stake and rechecking grade until stake is on grade.	__	__
e. Continue this procedure until all grade stakes are driven and on grade.	__	__
4. Clean work area; clean and store tools properly.	__	__

(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Stakes proper distance apart and in center of footing	4	3	2	1
Top of stakes are on grade	4	3	2	1
Time standard for 4 rating is 1 hour or less	4	3	2	1

EVALUATOR'S COMMENTS

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** – Can perform job with no additional training
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill
1 **Unskilled** – Is familiar with process, but is unable to perform job

WRITTEN TEST

SITE LAYOUT C 3

Name ______________________________ Score __________

OBJECTIVE 1

Given a list of alternatives, match terms associated with site layout to their correct definitions. Write the letter that corresponds to the most correct answer.

_____ 1. Which of the following terms *best* describes a sawed indentation in a ledger board that holds a line in place?

a. Notch
b. Slit
c. Kerf
d. Plumb mark

_____ 2. A line, established by law, to ensure a structure is a minimum distance from the right-of-way or property line is called a _______________ line.

a. setback
b. bench
c. center
d. grade

_____ 3. A batter board is used to lay out

a. property lines
b. building lines
c. location of utilities
d. grade levels

_____ 4. What is a device, attached to a string, used to check perpendicular or vertical alignment?

a. Level
b. Builder's level
c. Square
d. Plumb bob

May be photocopied for student use.

_____ 5. The boundaries of a lot or plot of ground is called the _______________ line.

a. building
b. easement
c. setback
d. property

_____ 6. What is the term for removing soil for footings or for establishing a uniform grade?

a. Plot setting
b. Surveying
c. Excavating
d. Preparing

OBJECTIVE 2 **Choose the correct definitions for terms associated with grades and leveling instruments.**

_____ 1. What is the term used for soil or other substances used to establish an existing grade?

a. Pack
b. Pillow
c. Fill
d. Level-grade

_____ 2. A permanent point of known or assumed elevation is called a/an

a. bench mark or BM
b. base level or BL
c. corner stone or CS
d. level point or LP

_____ 3. Which of the following terms describe a surveying instrument used primarily to establish angles and straight lines?

a. Plumb bob
b. Transit
c. Square
d. Tele-port

May be photocopied for student use

OBJECTIVE 3

Select from a list, factors pertinent to site layout.

_____ 1. Which of the following factors should be considered during the layout of a building site?

a. Location of utilities
b. Zoning restrictions
c. Characteristics of soil
d. All the above

_____ 2. When considering site layout factors, which of the following factors might be pertinent to site orientation?

a. Characteristics of soil
b. Scenery
c. Zoning restrictions
d. All of the above

OBJECTIVE 4

Given choices, pick the correct considerations used in laying out building lines.

_____ 1. Which of the following considerations should be used to lay out a building line?

a. Height of the building
b. Depth of the footing excavation
c. Length and width of the building
d. Property value

OBJECTIVE 5

From a list, differentiate the purpose of batter boards.

_____ 1. Which of the following statements best describe the purpose of batter boards?

a. Allows for easy transportation of concrete during bricklaying
b. Establishes the location of utilities
c. Provides a place for stretching a line used to establish building lines
d. Provides a place for stretching a line used to establish property lines

May be photocopied for student use.

OBJECTIVE 6

Given the name of the method, distinguish between proper and improper procedures used to square building lines.

_____ 1. When using the 3-4-5 method, which of the following triangle sizes should be used to check the squareness of the building line of a 60′ × 80′ structure?

a. 6′ × 8′ × 10′
b. 12′ × 16′ × 30′
c. 60′ × 80′ × 100′
d. 60′ × 80′ × 120′

_____ 2. Using the diagonal method, which of the following procedures is correct?

a. Measure diagonally from the inside corners of layout, and ensure that the diagonal lines are equal in length.
b. Measure the width of the building lines at the corners, and ensure each end is equal in width.
c. Measure diagonally, and ensure the distance is equal to ½ the width of the structure.
d. Measure the triangle formed by the intersection of the building lines.

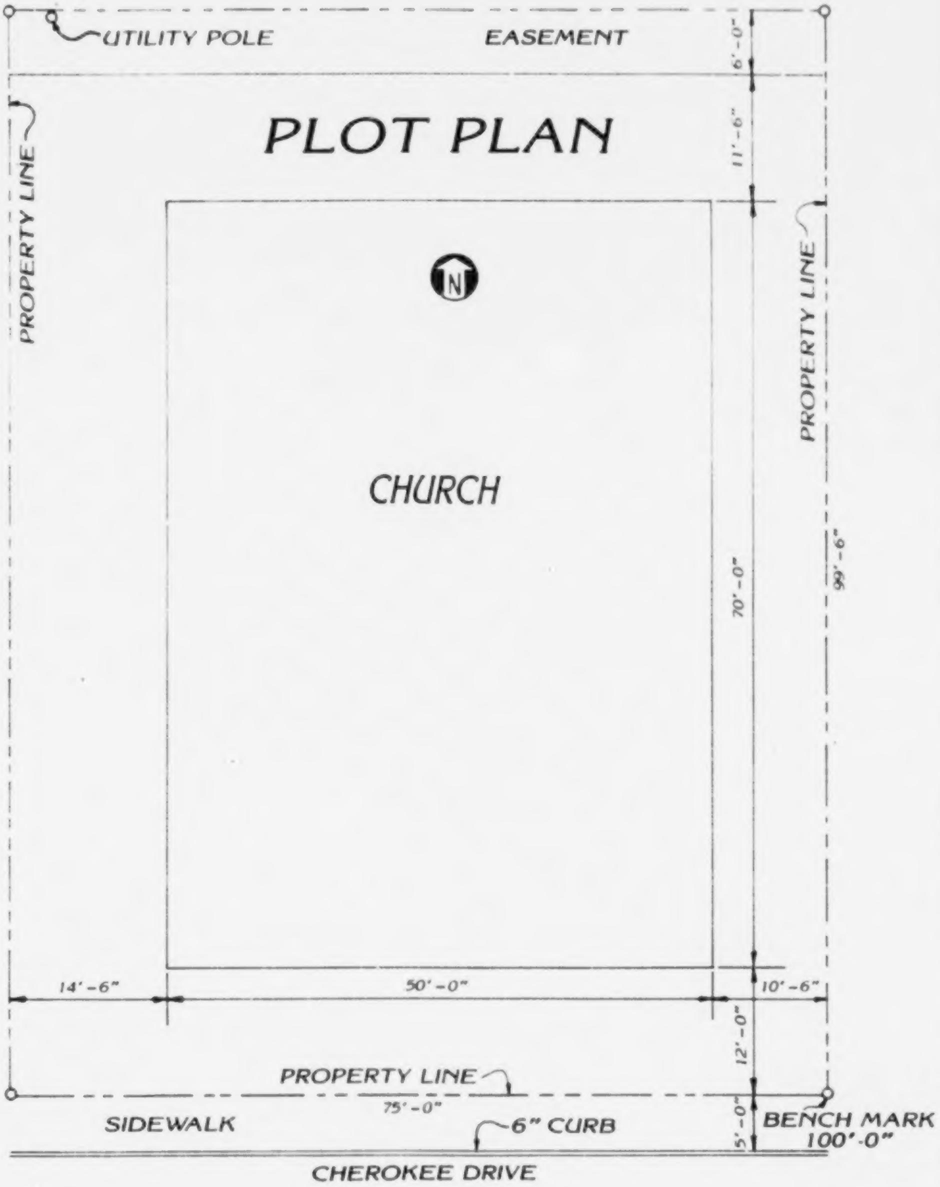
May be photocopied for student use.

WRITTEN TEST ANSWERS

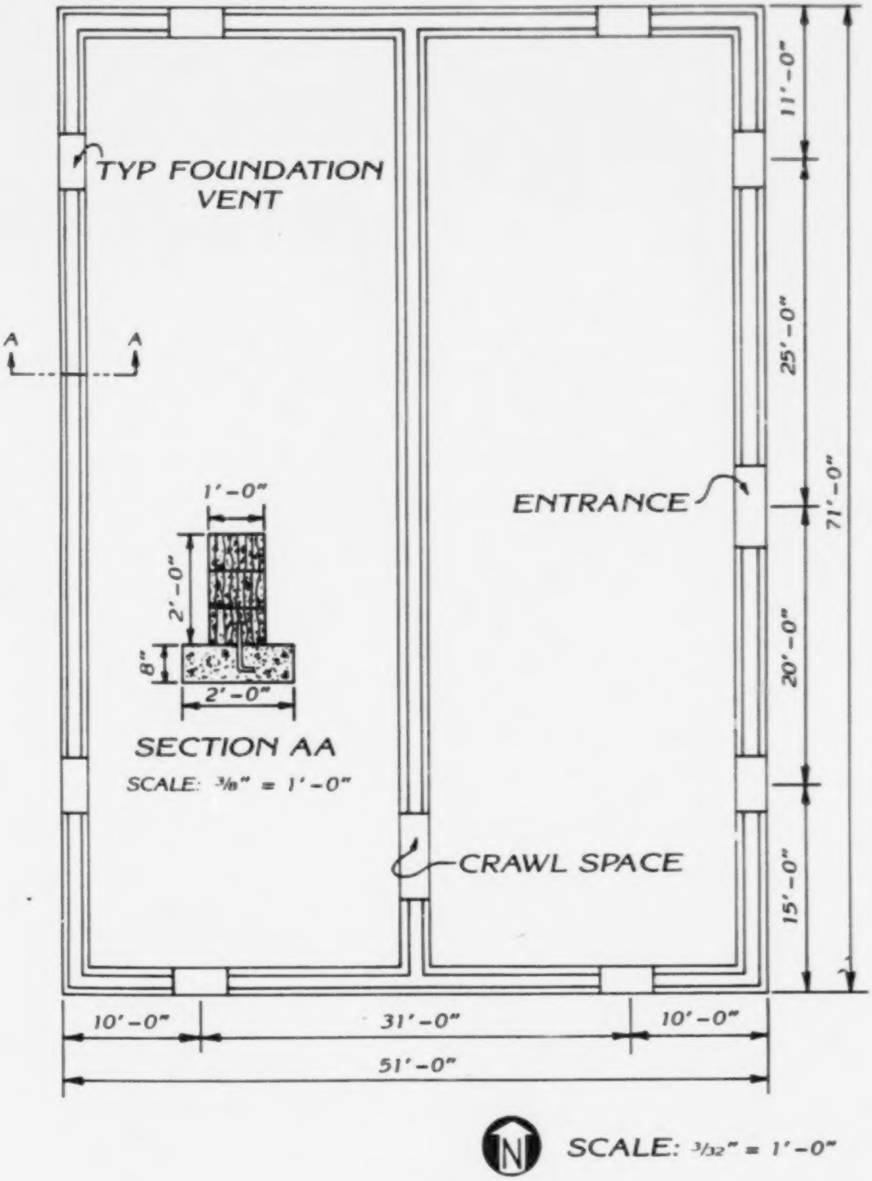
SITE LAYOUT

OBJECTIVE 1	1. c	4. d
	2. a	5. d
	3. b	6. c
OBJECTIVE 2	1. c	
	2. a	
	3. b	
OBJECTIVE 3	1. d	
	2. b	
OBJECTIVE 4	1. c	
OBJECTIVE 5	1. c	
OBJECTIVE 6	1. c*	
	2. a	

* Response "c" is the largest multiple possible for the line lengths given.


UTILITY POLE
EASEMENT
6'-0"
PLOT PLAN
11'-6"
PROPERTY LINE
PROPERTY LINE
CHURCH
N
70'-0"
99'-6"
14'-6"
50'-0"
10'-6"
12'-0"
PROPERTY LINE
75'-0"
SIDEWALK
6" CURB
5'-0"
BENCH MARK 100'-0"
CHEROKEE DRIVE

FOUNDATION PLAN


TYP FOUNDATION VENT
A
A
1'-0"
2'-0"
8"
2'-0"
SECTION AA
SCALE: 3/8" = 1'-0"
ENTRANCE
CRAWL SPACE
11'-0"
25'-0"
20'-0"
15'-0"
71'-0"
10'-0"
31'-0"
10'-0"
51'-0"
N
SCALE: 3/32" = 1'-0"

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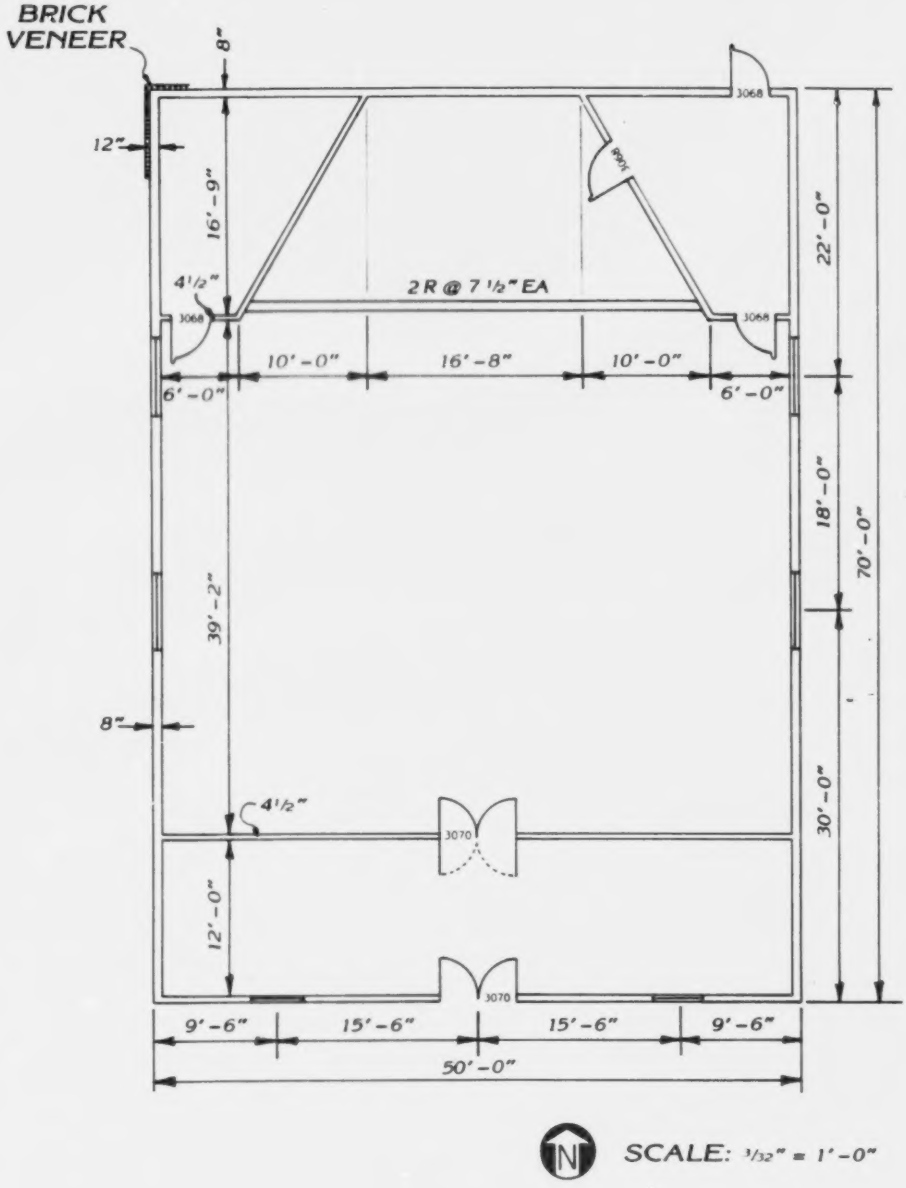
FLOOR PLAN


BRICK VENEER
8"
12"
16'-9"
4½"
3068
3068
3068
3068
2 R @ 7½" EA
10'-0"
16'-8"
10'-0"
6'-0"
6'-0"
22'-0"
18'-0"
70'-0"
39'-2"
8"
4½"
3070
3070
30'-0"
12'-0"
9'-6"
15'-6"
15'-6"
9'-6"
50'-0"
N
SCALE: 3/32" = 1'-0"

OBJECTIVE SHEET

COMMON TOOLS AND EQUIPMENT

D 1

INTRODUCTION

This unit provides you with the knowledge needed to recognize the various types of tools and equipment used within the construction industry.

Tools and equipment play an essential role in the construction workplace. Their safe use and proper care must be the very foundation of a professional construction worker's skills.

UNIT OBJECTIVE

After completing this unit, the student must be able to demonstrate these competencies by completing the assignment sheet and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to show the ability to:

1. Given a list of terms associated with construction tools and equipment, match them to their correct definitions.
2. Given drawings, match hand tools with their identities.
3. Given alternatives, identify common power tools and equipment used within the construction industry.
4. Given a list of terms associated with leveling instruments, match them to their correct definitions.
5. Given alternatives, match each type of leveling instrument to its use.
6. Given pictures of leveling instruments, identify operator controls and major elements by name.
7. Choose the proper guidelines for the safe handling of leveling instruments.
8. Given pictures, differentiate between hand signals used to maneuver vehicles. (Assignment Sheet 1)

9. Choose from a group of alternatives, the proper hand signal used to direct the operation of forklifts. (Assignment Sheet 2)

PREPARATION

Review unit and plan presentation

- Study the specific objectives to determine the order in which you will present the objectives.
- Review teaching suggestions given in the Delivery section and plan classroom activities.
- Plan presentation to take advantage of student learning styles and to accommodate students with special needs.
- Invite a tool salesperson to speak to the students about buying tools. Suggest they compare quality tools to poor ones and discuss cost.
- Show the students common tools used in construction. Take them to a construction site to point out larger pieces of equipment.
- Order or obtain materials listed in suggested resources.
- Obtain other materials to supplement unit.

  EXAMPLES: Tools catalogs, samples of the various tools.

DELIVERY

Objective 1: Given a list of terms associated with construction tools and equipment, match them to their correct definitions.

- Discuss terms and definitions.
- Show students examples to illustrate appropriate terms.
- Show slide set, *Tool Identification Slides*.

Objective 2: Given drawings, match hand tools with their identities.

- Discuss the various types of hand tools.

- Display samples of hand tools and discuss their use.
- Caution the students about the dangers in tool use and the importance of wearing safety equipment such as hardhats and goggles.

Objective 3: Given alternatives, identify common power tools and equipment used within the construction industry.

- Discuss the various types of power tools.
- Use the information sheets to illustrate each type and show others using catalogs and magazines.
- Discuss the safety issues in the use of power tools. Many require the operator to be trained and certified in their safe use.
- Discuss the electrical requirements of many power tools and stress the importance of using grounded power cords and extension cords.

Objective 4: Given a list of terms associated with leveling instruments, match them to their correct definitions.

- Discuss terms and definitions associated with leveling instruments.
- Show students actual instruments—such as a level, laser-beam instrument, and transit—and examples of other objects—such as a leveling rod, grade stake, range poles and plumb bob.
- Take the students to a construction site to demonstrate surveying and concepts such as slope, elevation, fall, bench mark, finish-floor height, grade line, etc.
- Set up a transit and a level, and have students look through the telescopes to reinforce your discussion of reticle and stadia, cross hairs, and line of sight.

Objective 5: Given alternatives, match each type of leveling instrument to its use.

- Discuss transit types and uses.
- Compare the uses of transits and levels, emphasizing when it is more appropriate to use a transit.
- Show the students examples of the various types of transits illustrated in this section of the information sheet.
- Discuss the level-transit, emphasizing that, as the name suggests, it is a combination tool that is becoming very popular in construction.
- Discuss the uses of the various types of transits, emphasizing the possible advantages and disadvantages of each type.

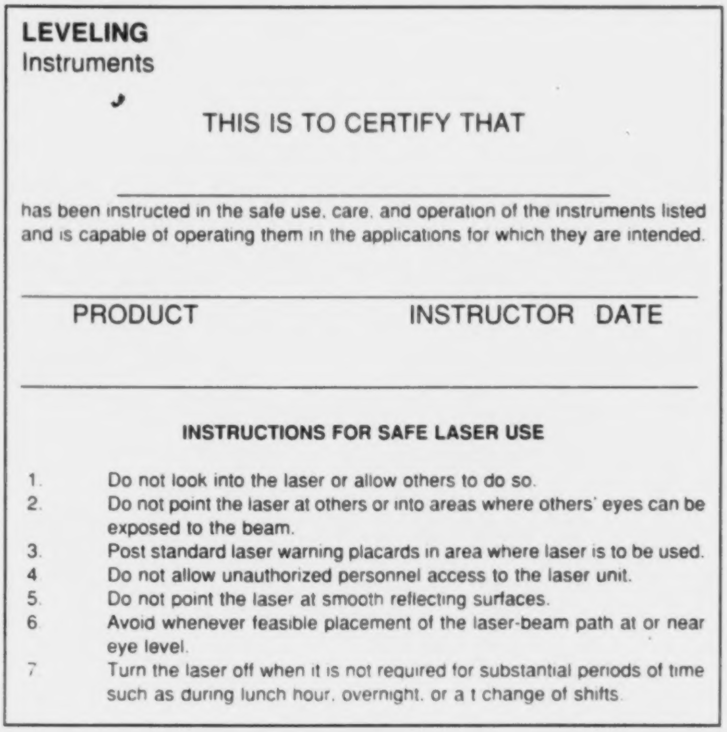
Objective 6: Given pictures of leveling instruments, identify operator controls and major elements by name.

- Discuss types of leveling instruments and parts of a level.
- Show the students examples of the various types of levels illustrated in the information sheet. Point out the various parts of the levels and demonstrate adjustment of all operator controls of the instrument.
- Discuss the uses of the various types of levels, emphasizing the possible advantages and disadvantages of each type.
- Explain to students that the automatic level and the laser-beam instrument are the types of levels that they will see being used on large construction jobs; however, the builder's level and the combination level-transit are the two types that they will be most likely to use themselves.

  NOTE: The automatic (compensating) level is becoming more popular and has proved to be more durable than the builder's level, stays in adjustment longer, requires less maintenance and adjustment and is faster to set up and easier to use.

- Explain that a certification card must be earned before a person can use a laser-beam instrument. Also explain that government regulations require a warning to be included on literature concerning laser-beam instrument use.

EXAMPLE:



LEVELING
Instruments

THIS IS TO CERTIFY THAT

____

has been instructed in the safe use, care, and operation of the instruments listed and is capable of operating them in the applications for which they are intended.

PRODUCT INSTRUCTOR DATE

INSTRUCTIONS FOR SAFE LASER USE

1. Do not look into the laser or allow others to do so.
2. Do not point the laser at others or into areas where others' eyes can be exposed to the beam.
3. Post standard laser warning placards in area where laser is to be used.
4. Do not allow unauthorized personnel access to the laser unit.
5. Do not point the laser at smooth reflecting surfaces.
6. Avoid whenever feasible placement of the laser-beam path at or near eye level.
7. Turn the laser off when it is not required for substantial periods of time such as during lunch hour, overnight, or a t change of shifts.

- Hand out copies of the certification card/warning and discuss with the class.

Objective 7: Choose the proper guidelines for the safe handling of leveling instruments.

- Discuss proper care of leveling instruments.
- Discuss the cost of leveling instruments and emphasize the delicacy of the instruments.
- Demonstrate to students the proper procedures for removing transits and levels from their carrying cases, setting up the instruments, and attaching a plumb bob to the instruments; acquaint students with your rules for student use of the instruments.

APPLICATION

Objective 8: Given pictures, differentiate between hand signals used to maneuver vehicles. (Assignment Sheet 1)

- Describe the busy nature of a construction site and the importance of hand signals to assist in the safe movement of vehicles.
- Have students complete Assignment Sheet 1.

Objective 9: Choose, from a group of alternatives, the proper hand signal used to direct the operation of forklifts. (Assignment Sheet 2)

- Discuss the use of hand signals in the safe operation of forklifts.
- Describe the need to be certified in the operation and safe use of a forklift.
- Assign students to complete Assignment Sheet 2.

EVALUATION

Pretest

- Give written test as pretest.
- Determine individual study requirements from pretest results.
- Counsel students individually on pretest results and study requirements.
- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.
- Evaluate students on job sheet activities.
- Complete appropriate section of competency profiles.
- Reteach and reevaluate if necessary.
- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.

  NOTE: The written test may be given in sections if desired.

- Give the written test.
- Complete appropriate sections of competency profiles.
- Reteach and retest if necessary.
- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Electronic Media

- *Safety In The Shop: Hand Tools.* Black and white 13.5 min., Coronet Films, available from Coronet Films, 65 East Southwater Street, Chicago, IL 70701.

- *Tool Identification Slides.* Available from the Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, 1500 West Seventh Avenue, Stillwater, OK 74074.

- *Power and Hand Tool Safety*: ½" VHS Color 21 min. 1987. Available from Tel-A-Train, 309 N. Market Street, Chattanooga, TN 37405.

  This program demonstrates proper methods of selection, inspection, and use of hand tools, portable power tools, both on the job and at home. The importance of exercising judgment and control before, during, and after the job is emphasized.

- *Powder Actuated Tool Safety.* Available from AGC of America, 1957 E. Street N.W., Washington, D.C. 20006.

- *Working Around Construction Equipment Safely.* Available from AGC of America, 1957 E. Street N.W., Washington, D.C. 20006.

Print Media

- Tool catalogs from various manufacturers

  EXAMPLES: Stanley Tools, Division of the Stanley Works, 600 Myrtle Street, New Britain, CT 06050.

  General Hardware Manufacturing Co., Inc. 800 Whitestreet, New York, NY 10013.

  NOTE: Obtain several catalogs and display for students to review.

UNIT REFERENCES

- Consumer Products, Catalog 319. Black & Decker (U.S.) Inc.: Towson, MD.
- *DUO-FAST Construction Tools*. FORM NO. PB-2. Duo-Fast Corporation. Franklin Park, IL.
- DX350 Instruction Manual. Hilti Corporation, Hilti Fastening Systems: Tulsa, OK.
- *Heavy Duty Professional Power Tools and Accessories for Construction and Industry*, Catalog NAPE-9. Black & Decker Industrial/Construction Division: Hampstead, MD, 1990.
- *Instructional Manual Sawbuck Frame and Trim Saw, Part No. 422-25-651-0003 Delta International Machinery Corp.: Pittsburgh, Pennsylvania, 1992.*
- *Makita Tool Catalog. Makita U.S.A. Inc.: Cerritos, CA, 1992.*
- *Rockwell Professional Power Tools*, Catalog No. AD-3700. Rockwell International Power Tool Division: Pittsburgh, PA.
- *Stanley Tools Consumer Broad Line Catalog*. South Central Corporate Distribution Center: Dallas, TX.
- *Starrett Precision Tools, Gages and Saws*. The L. S. Starrett Company: Athol, MA.
- Toenjes, L. P. *Building Trades Dictionary*. American Technical Publishers, Inc.: Homewood, Illinois, 1989.
- Wagner, Willis H. *Modern Carpentry*. The Goodheart-Wilcox Co., Inc.: South Holland, IL.
- Willey, Al. *Fundamentals of Carpentry*. Stillwater, OK: Oklahoma Department of Vocational and Technical Education and the Associated General Contractors of America, 1993.

INFORMATION SHEET

COMMON TOOLS AND EQUIPMENT

D 1

OBJECTIVE 1

Given a list of terms associated with construction tools and equipment, match them to their correct definitions.

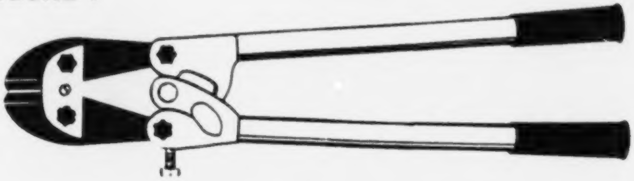
- **air compressor** — a device used to elevate air pressure
- **battery-powered tools** — tools, such as portable drills, that use rechargeable batteries as a power source. They are purchased with battery chargers that allow overnight recharging.
- **bit** — often referred to as a drill bit and used as a cutting tool to bore holes
- **booster** — powder load used to project fasteners in powder-actuated tools
- **door jack** — holder or stand used to hold door on edge while planing, routing, or installing hinges
- **drive pin** — fastener used in a powder-actuated tool
- **hone** — process of sharpening a cutting tool on a stone
- **kickback** — sharp, violent reaction of a tool as it rejects material being forced into it
- **miter box** — device used to guide a saw at the proper angle for cutting a miter joint
- **nibbler** — used to "nibble" through metal. Allows for making curved cuts and is very useful in cutting corrugated steel
- **pneumatic** — powered or operated by compressed air
- **powder-actuated tool** — a tool that drives fasteners by means of an explosive charge
- **power buggy** — a gasoline-powered device used similarly to a wheelbarrow to transport concrete and other material around a construction site

- **power shear** — a tool used to cut metals and plastics
- **protractor** — instrument used to lay out angles
- **P.S.I.** — pounds per square inch; often refers to the air pressure used with various air-power tools (see pneumatic)
- **push stick** — safety device used to push material through cutters to protect fingers from being cut
- **relief cut** — cut in stock that keeps blade from binding
- **rotary hammer** — a power tool that can be used to bore holes through extremely hard concrete. It rotates while using a piston for percussion
- **soapstone** — soft stone having a soapy feel; used for marking metal and masonry
- **watt** — a unit of measure for electrical power and often used to evaluate the output capacity of portable alternators/generators
- **wet/dry vacuum cleaner** — vacuum cleaner that has been designed to collect and store either dry or wet substances (examples: sawdust or water)

OBJECTIVE 2 **Given drawings, match hand tools with their identities.**

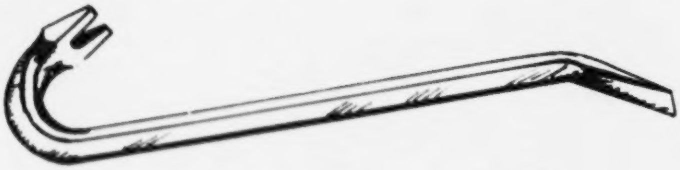
- Bolt cutters

FIGURE 1



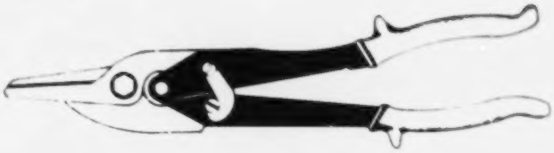
- Wrecking bar

FIGURE 2



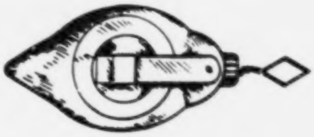
- Metal snips

FIGURE 3



- Chalk box and line

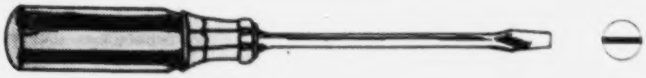
FIGURE 4



- Screwdrivers

  1. Standard (flat blade)

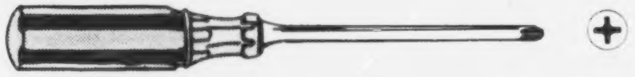
FIGURE 5



451

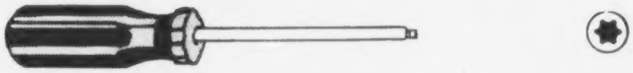
2. Phillips

FIGURE 6



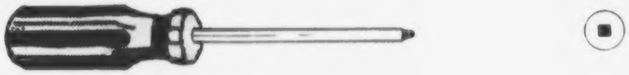
3. Torx-head

FIGURE 7



4. Square-head (Robertson)

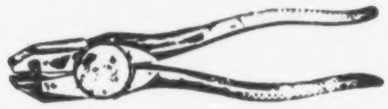
FIGURE 8



- Pliers

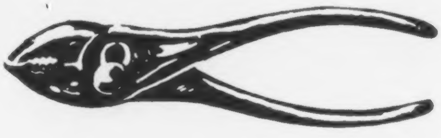
1. Side cut

FIGURE 9



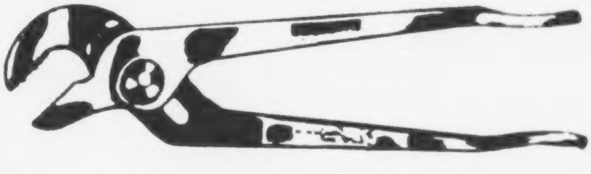
2. Combination slip-joint

FIGURE 10



3. Channel-lock

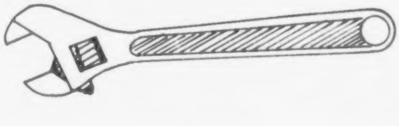
FIGURE 11



- Wrenches

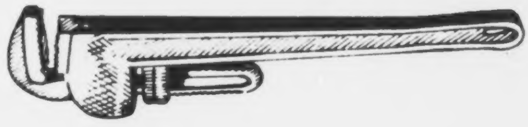
1. Adjustable

FIGURE 12



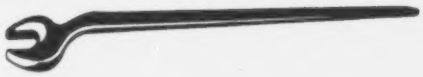
2. Pipe

FIGURE 13



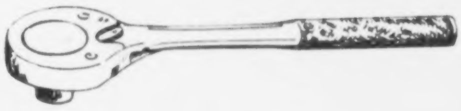
3. Spud (structural)

FIGURE 14



4. Ratchet wrench

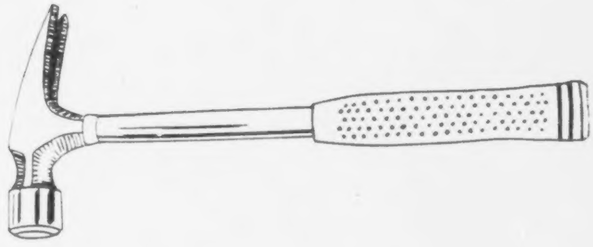
FIGURE 15



- Hammers

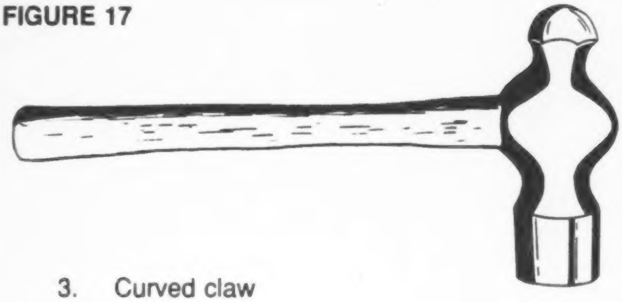
  1. Straight claw

FIGURE 16



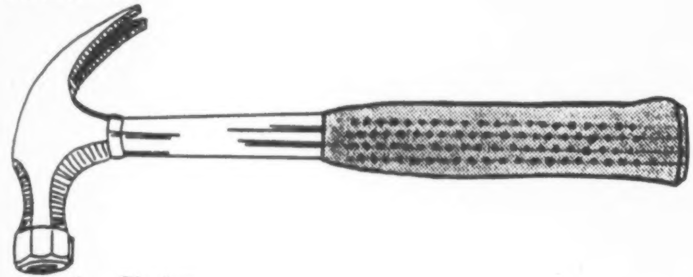
2. Ball peen

FIGURE 17



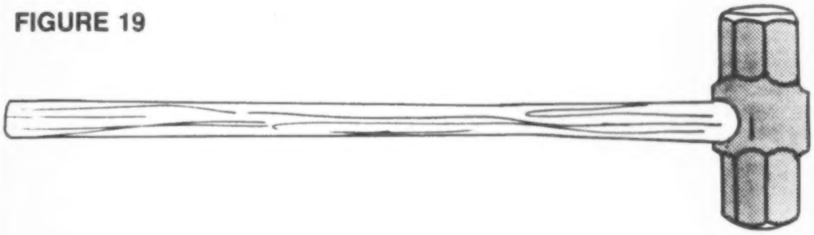
3. Curved claw

FIGURE 18



4. Sledge

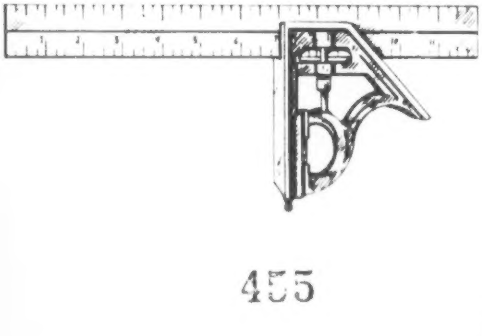
FIGURE 19



- Squares

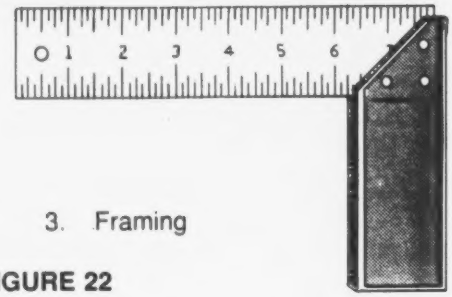
    1. Combination

FIGURE 20



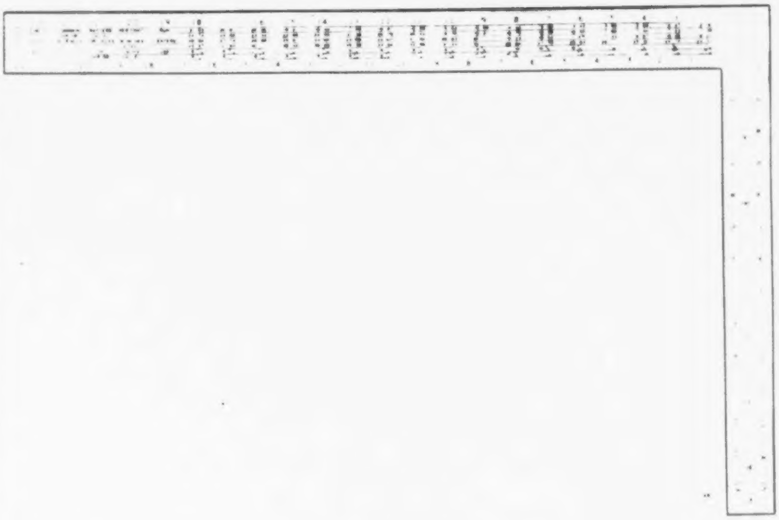
2. Try

FIGURE 21



3. Framing

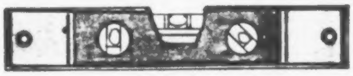
FIGURE 22



- Hand levels

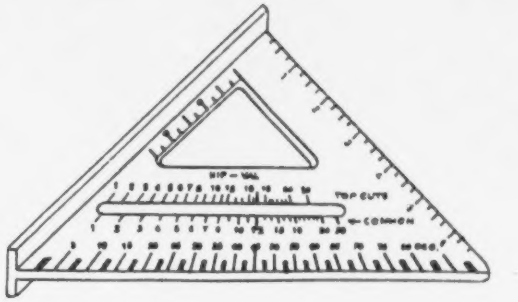
    1. Torpedo

FIGURE 23



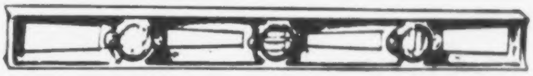
2. Speed square

FIGURE 24


HIP — VAL
TOP CUTS
← COMMON
DEG.

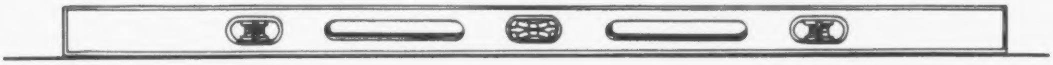
3. Aluminum utility

FIGURE 25



4. 48-inch mason's

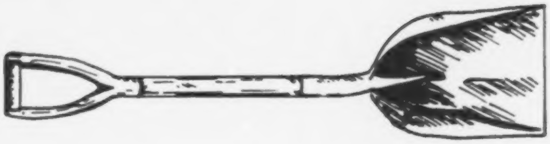
FIGURE 26



- Shovels

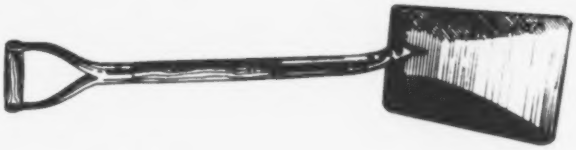
  1. Scoop

FIGURE 27



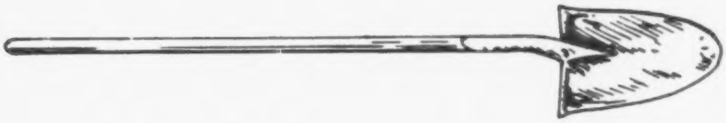
  2. D-handled, square point

FIGURE 28



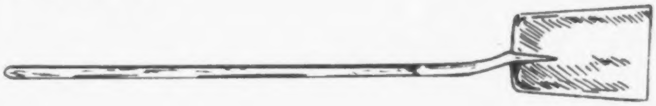
  3. Long-handled, round point

FIGURE 29



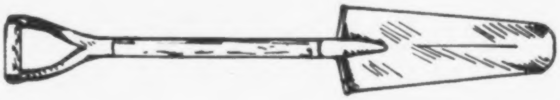
  4. Long-handled, square point

FIGURE 30



5. Spade (sharpshooter)

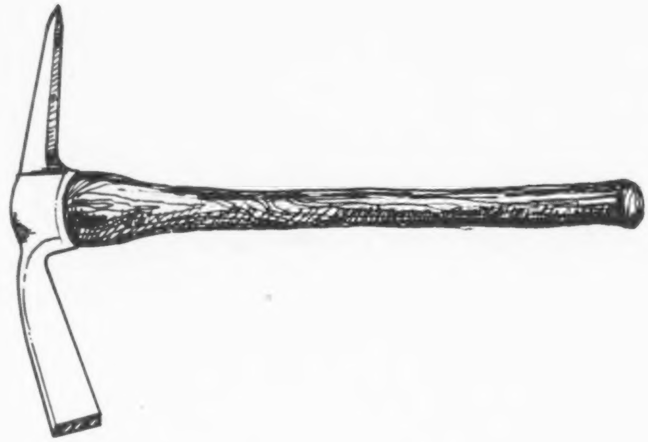
FIGURE 31



- Miscellaneous tools

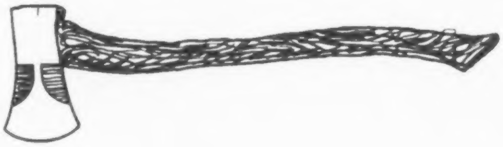
  1. Mattock

FIGURE 32



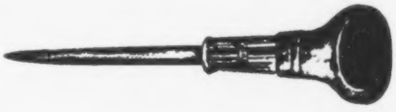
  2. Axe

FIGURE 33



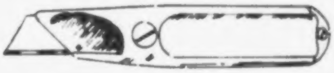
3. Scratch awl

FIGURE 34



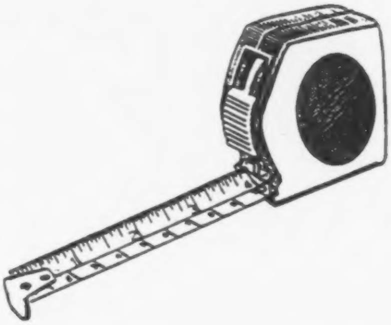
4. Utility knife

FIGURE 35



5. Steel tape

FIGURE 36

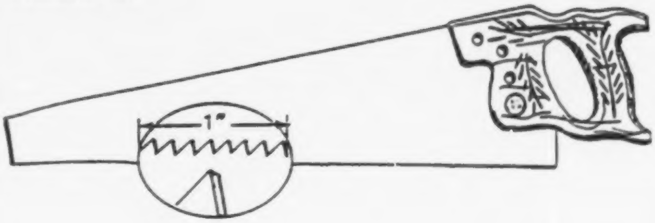


400

- Saws

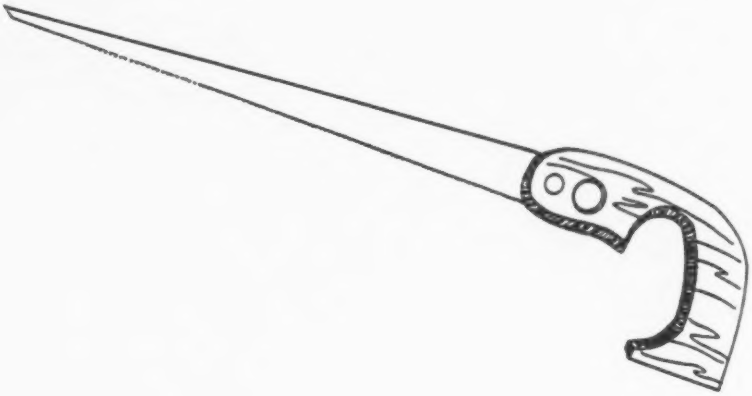
  1. Handsaw

FIGURE 37



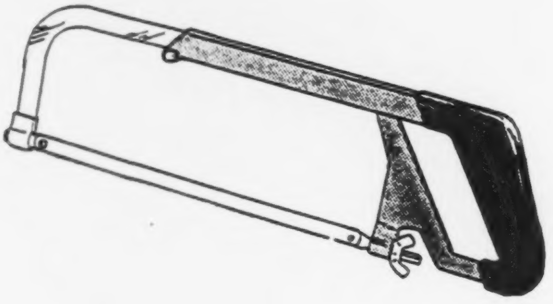
  2. Keyhole

FIGURE 38



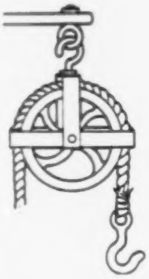
3. Hacksaw

FIGURE 39



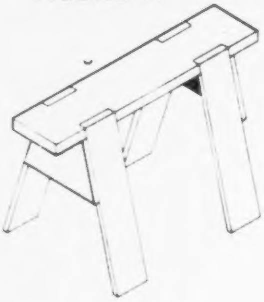
- Well pulley

FIGURE 40



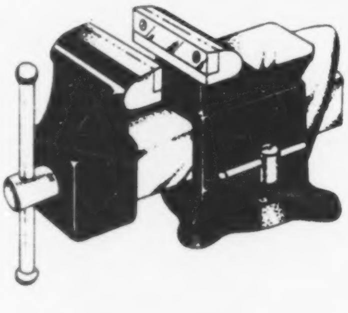
- Sawhorse

FIGURE 41



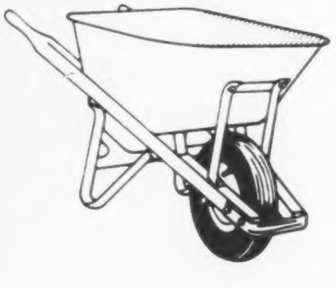
- Bench vise

FIGURE 42



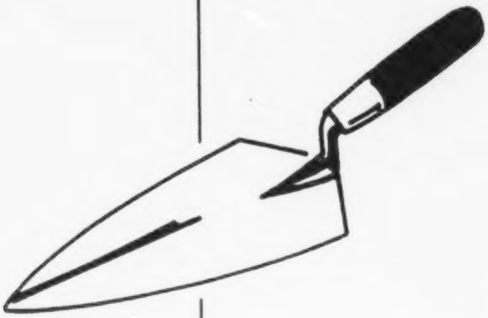
- Wheelbarrow

FIGURE 43



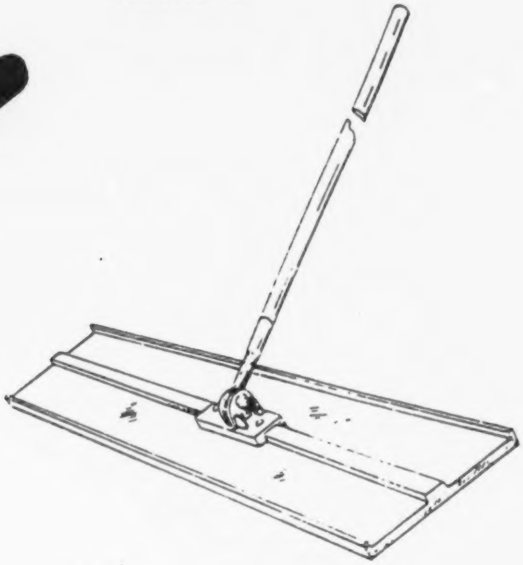
- Trowel

FIGURE 44



- Metal bullfloat

FIGURE 45

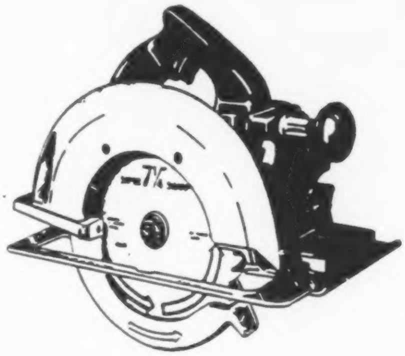


OBJECTIVE 3

Given alternatives, identify common power tools and equipment used within the construction industry.

- Circular saw

FIGURE 46



- Hand drills

    1. ¼-inch hand drill
    2. ½-inch hand drill

FIGURE 47

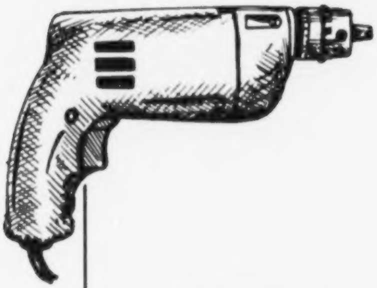
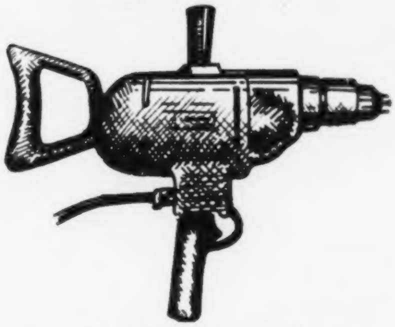
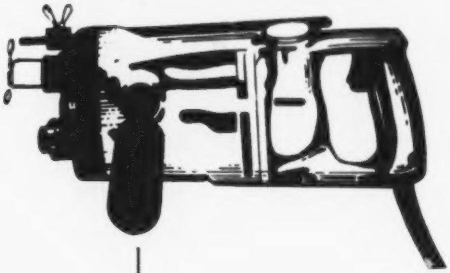


FIGURE 48



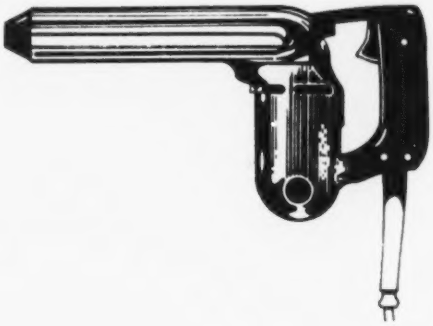
- Rotary hammer

FIGURE 49



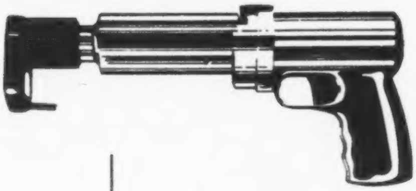
- Electric percussion hammer

FIGURE 50



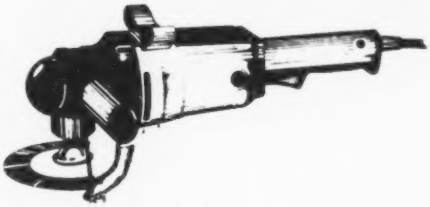
- Powder-actuated tool

FIGURE 51



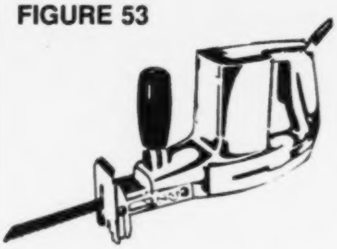
- Portable angle grinder

FIGURE 52



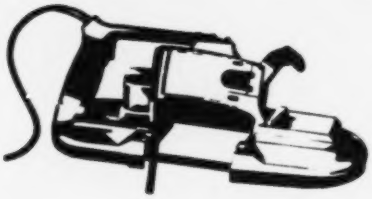
- Reciprocating saw

FIGURE 53



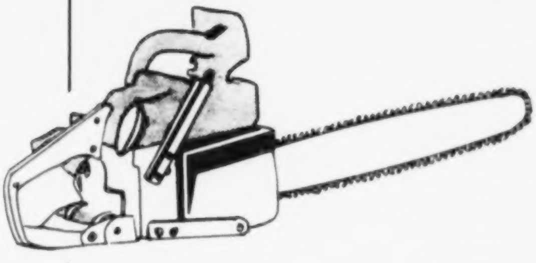
- Band saw

FIGURE 54



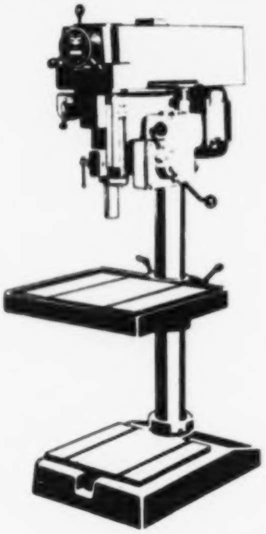
- Chain saw

FIGURE 55



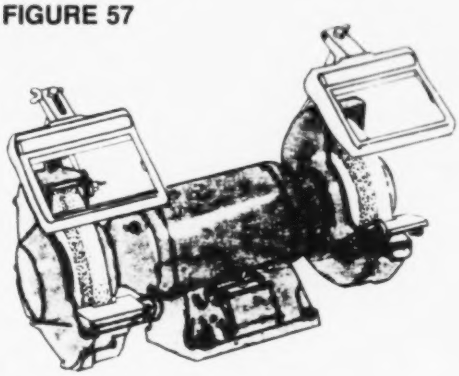
- Drill press

FIGURE 56



- Bench grinder

FIGURE 57



- Air compressors

FIGURE 58 Gasoline

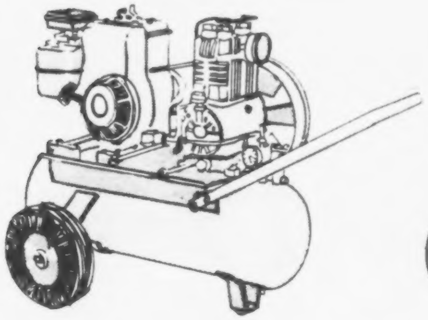
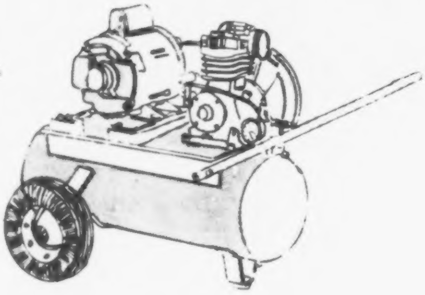
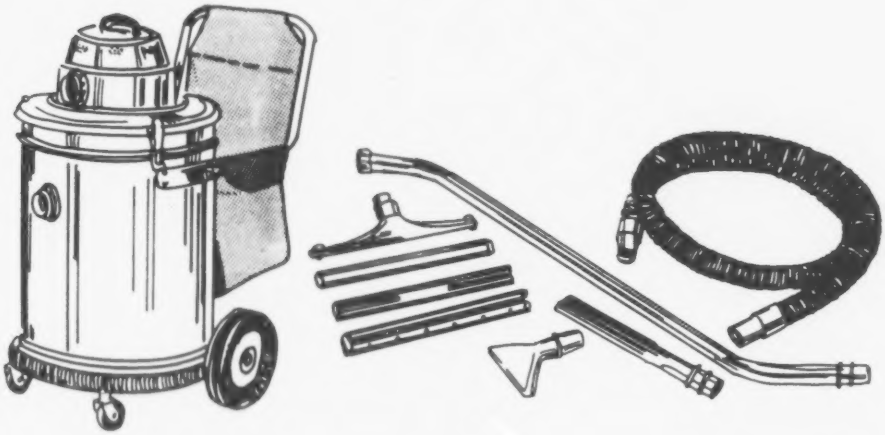


FIGURE 59 Electric



- Vacuum cleaner and accessories

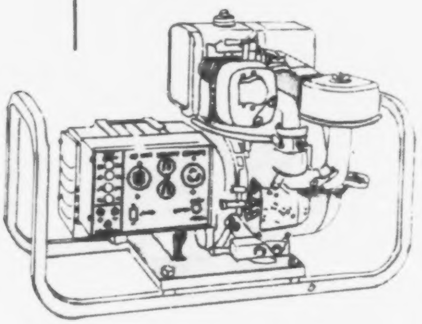
FIGURE 60



votech

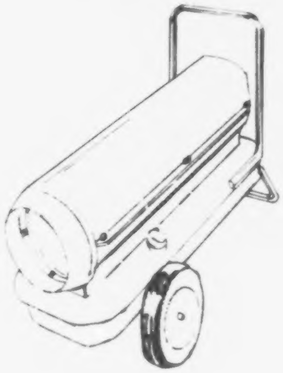
- Alternator (generator)

FIGURE 61



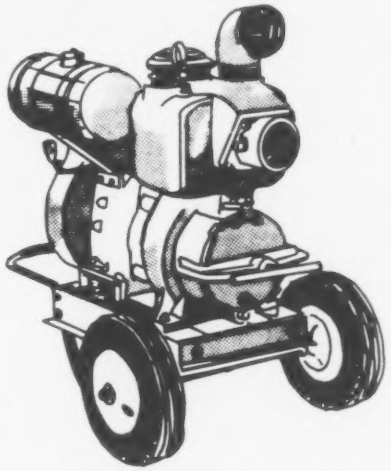
- Space heater

FIGURE 62



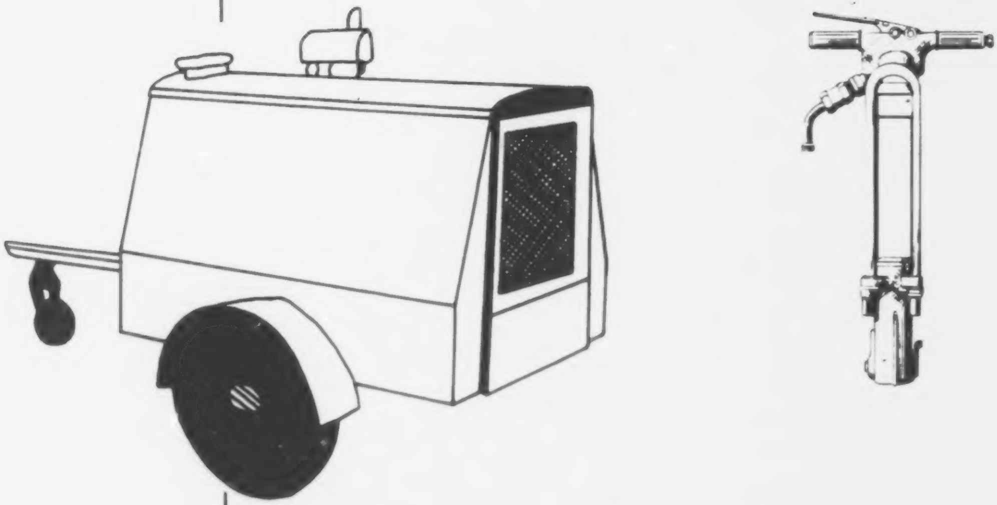
- Water pump

FIGURE 63



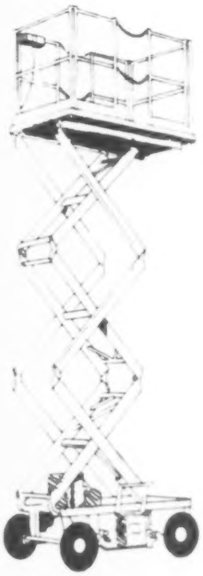
- Air compressor and paving breaker

FIGURE 64



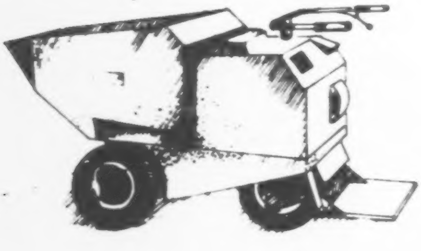
- Power lift

FIGURE 65



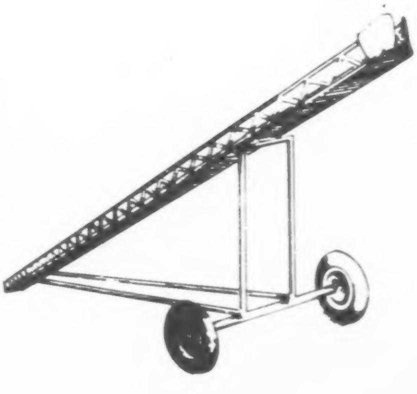
- Power buggy

FIGURE 66



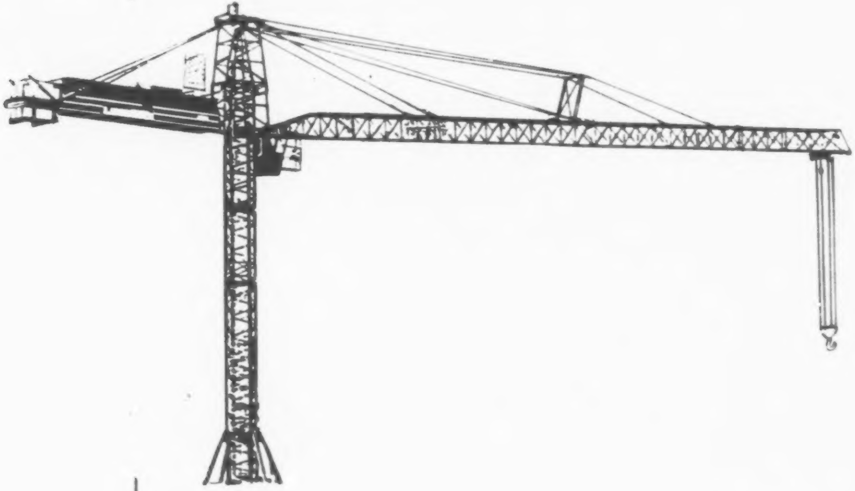
- Conveyor

FIGURE 67



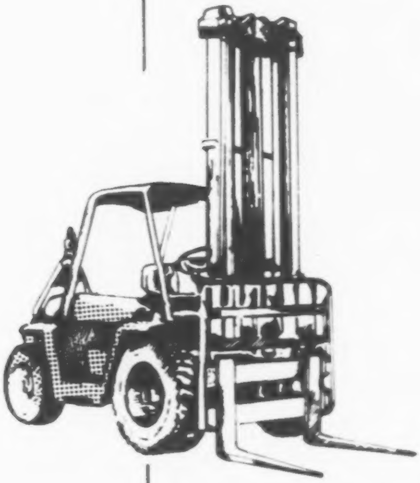
- Tower crane

FIGURE 68



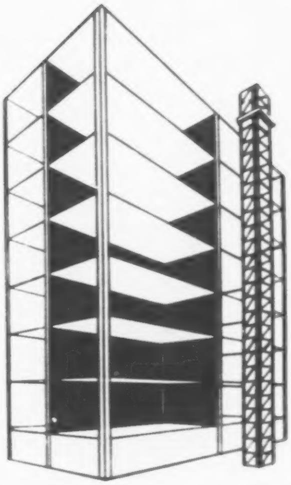
- Forklift

FIGURE 69



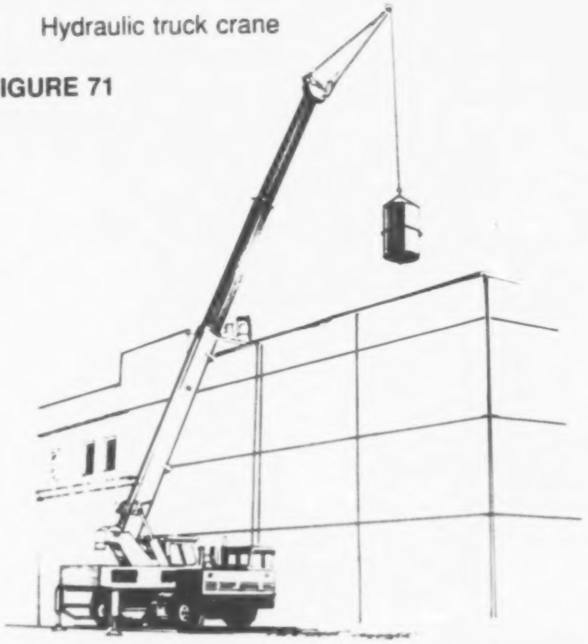
- Vertical hoist

FIGURE 70



- Hydraulic truck crane

FIGURE 71



OBJECTIVE 4

Given a list of terms associated with leveling instruments, match them to their correct definitions.

- **bench mark (BM)** — permanent point of known elevation

  NOTE: The bench mark is a specific point that may be located on a permanent structure such as a curb or culvert.

- **cross hairs** — fine horizontal and vertical lines in the telescope of a leveling instrument
- **EDM** — Electronic distance meter
- **elevation** — given grade
- **fall** — difference between elevations of two points on a slope
- **field book** — small book used to record instrument readings for layout and elevations of proposed structures

- **finish-floor height** — elevation of finished floor in relation to bench mark

- **grade line** — proposed or future level

- **grade stake** — stake driven into ground at given elevation

  NOTE: Elevation of grade stake is established from the bench mark.

- **height of instrument (HI)** — vertical distance from bench mark to line of sight of leveling instrument

- **laser-beam instrument** — automatic level that uses a laser beam to establish elevation readings

- **level** — optical leveling instrument consisting of a telescope and leveling bubble; used with a tripod and leveling rod primarily for establishing grade levels

- **leveling rod** — rod with markings graduated upward from zero; used with leveling instruments to determine elevations

- **plumb bob** — device attached to a string; used to set and check the vertical position

- **range pole** — a tall straight staff used to mark alignment while sighting a point; usually marked red and white alternately at 1 foot intervals

- **run** — horizontal distance between two points

- **site** — plot of ground on which a project is to be constructed

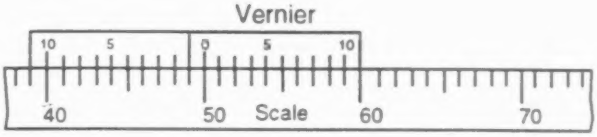
- **slope** — incline or pitch

- **surveying** — art and science of determining area and configuration of portions of the earth's surface with a maximum of accuracy and a minimum of time and expense

- **transit** — very precise instrument used to establish straight lines and to measure horizontal and vertical angles
- **vernier** — short auxiliary scale set parallel to and beside a primary scale; provides fractional parts of the smallest scale divisions without interpolating

  EXAMPLE:

FIGURE 72

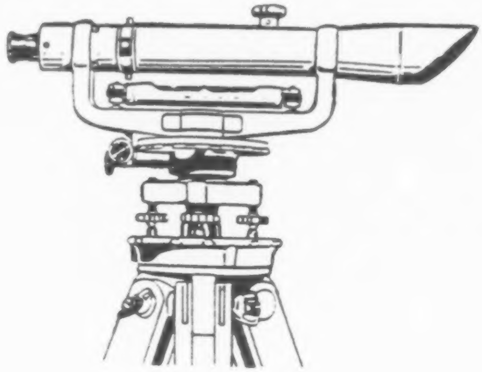


OBJECTIVE 5 **Given alternatives, match each type of leveling instrument to its use.**

- Levels
  - — List uses of a level
    - – Establish elevations and grades
    - – Establish differential elevations
    - – Transfer elevations from one point to another

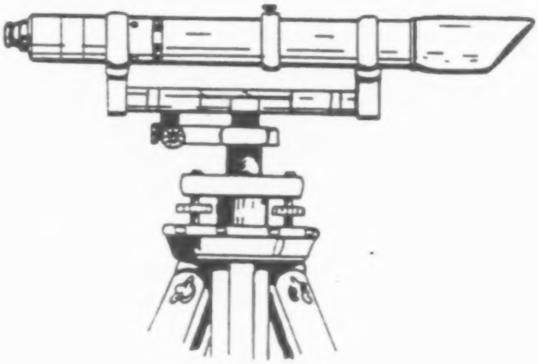
- Identify types of levels.
  - Builder's level

FIGURE 73



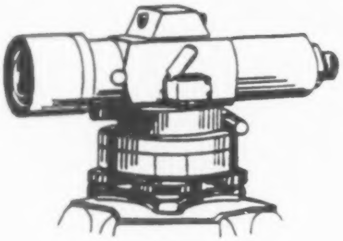
  - Dumpy level

FIGURE 74



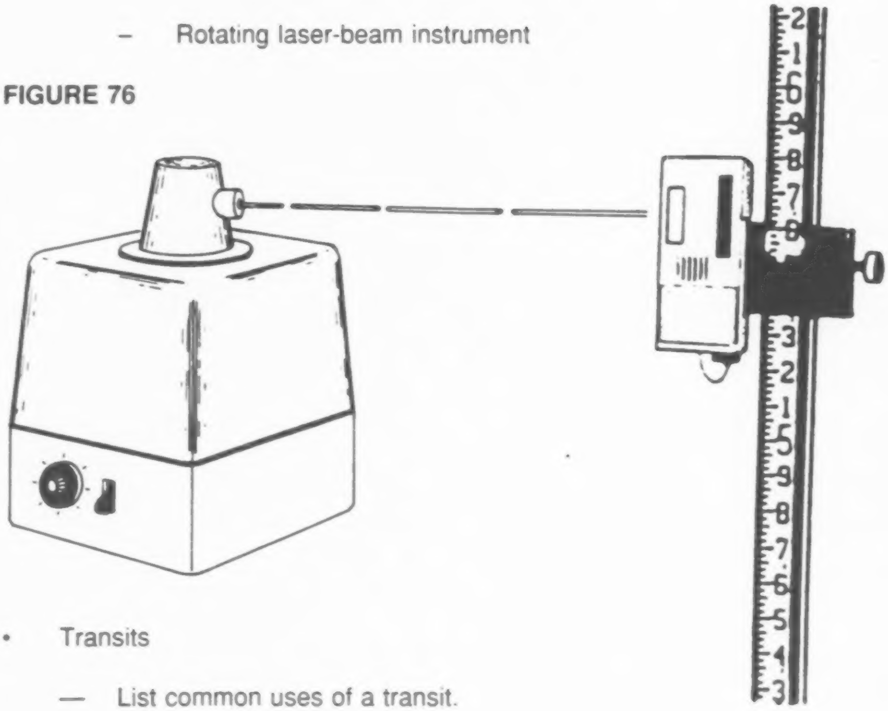
  - Automatic level

FIGURE 75



  - Rotating laser-beam instrument

FIGURE 76



- Transits
  - List common uses of a transit.
    - Measure horizontal angles
    - Measure vertical angles
    - Measure elevations

- Lay out boundaries and building lines
- Establish elevations and grades

NOTE: A leveling instrument is the preferred instrument for establishing grades, but a transit can be used if a level is not available.

— Identify types of transits.

- Engineer's transit
- Combination level transit

FIGURE 77

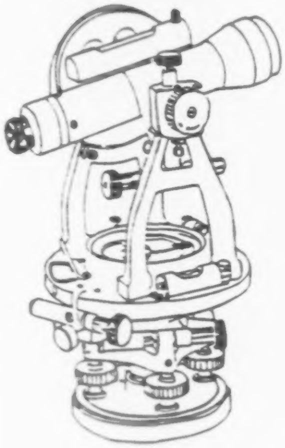
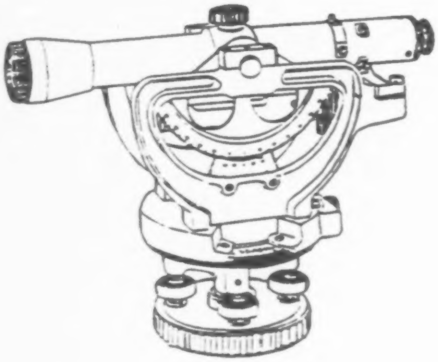


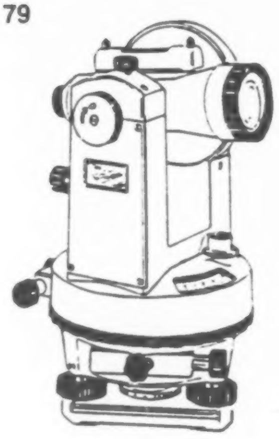
FIGURE 78



476

- Optical plum transit

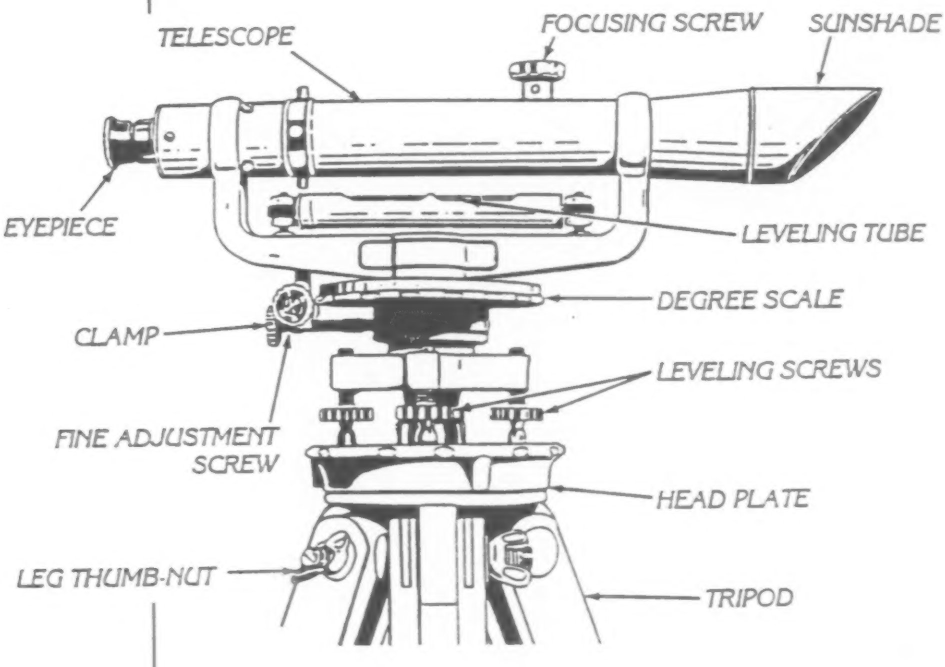
FIGURE 79



OBJECTIVE 6 **Given pictures of leveling instruments, identify operator controls and major elements by name.**

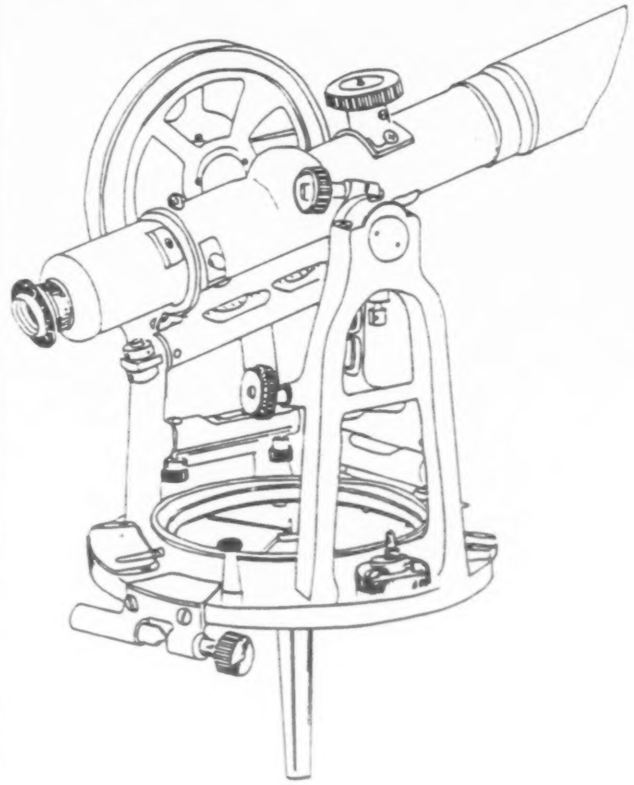
- Identify controls and major elements of a level.

FIGURE 80


TELESCOPE
FOCUSING SCREW
SUNSHADE
EYEPIECE
LEVELING TUBE
DEGREE SCALE
CLAMP
LEVELING SCREWS
FINE ADJUSTMENT SCREW
HEAD PLATE
LEG THUMB-NUT
TRIPOD

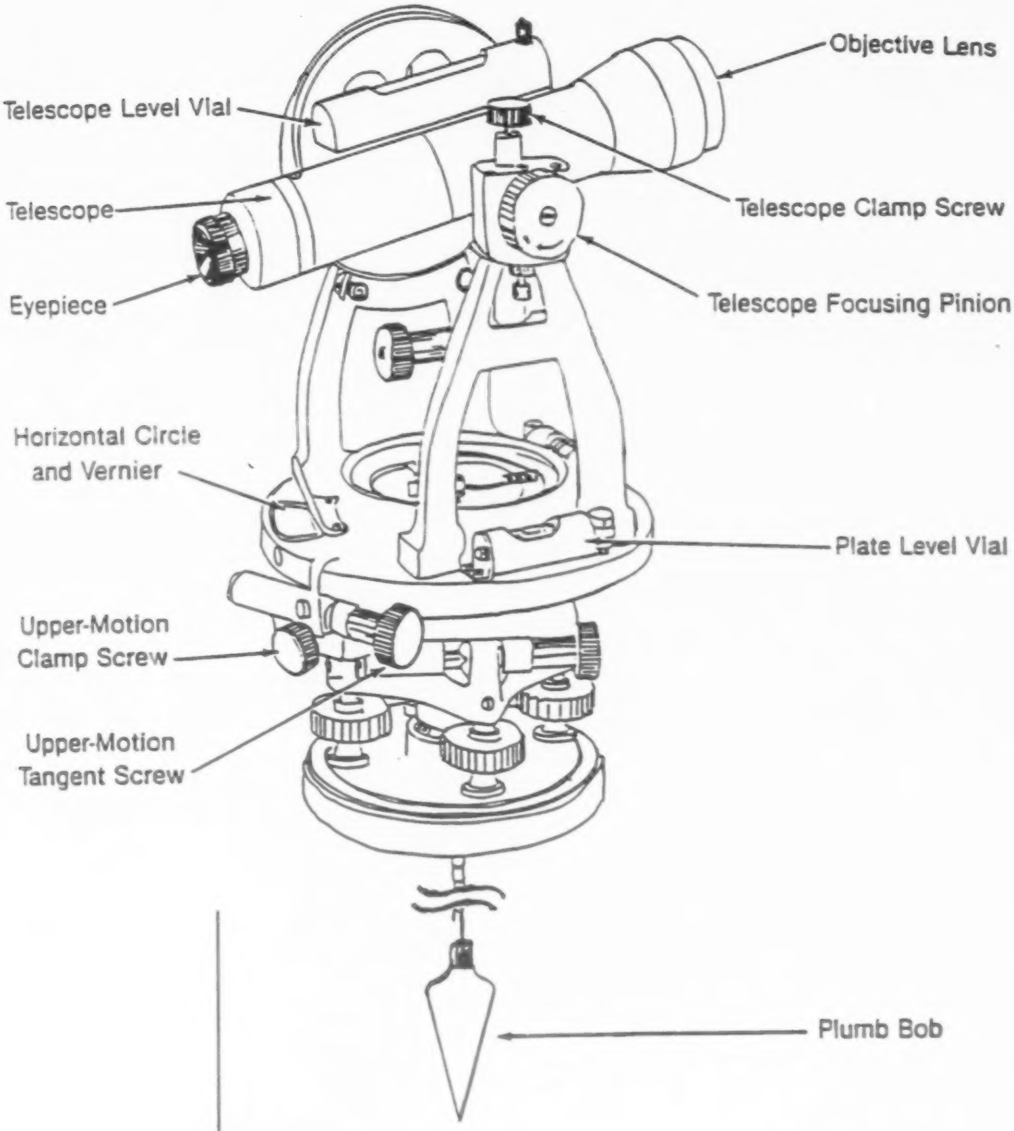
- Identify elements of a transit.
  - Three major elements of a transit
    - Alidade

FIGURE 81



- Identify elements of a transit.

FIGURE 82


Objective Lens
Telescope Level Vial
Telescope Clamp Screw
Telescope
Telescope Focusing Pinion
Eyepiece
Horizontal Circle and Vernier
Plate Level Vial
Upper-Motion Clamp Screw
Upper-Motion Tangent Screw
Plumb Bob

OBJECTIVE 7

Choose the proper guidelines for the safe handling of leveling instruments.

NOTE: Leveling instruments are sensitive instruments that require extremely careful treatment.

- Keep the instrument in carrying case when not in use.
- Protect the instrument from shock and vibration when transporting.
- Remove the instrument from carrying case by lifting the level bar.

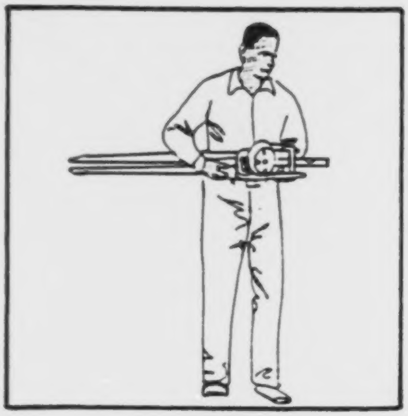
  NOTE: Never grasp the telescope barrel while removing instrument from the carrying case.

- *Never force screws* or other moving parts of the instrument.
- Place lens and tripod caps in carrying case after removing them from the instrument.
- Do not remove lenses.
- Clean lenses with soft tissue only.
- Always use sunshade regardless of weather.
- Loosen leveling screws before returning the instrument to carrying case.
- Carry tripod under your arm with the instrument in front of you. (Figure 83)

  NOTE: Never carry tripod over your shoulder when the instrument is attached.

EXAMPLE:

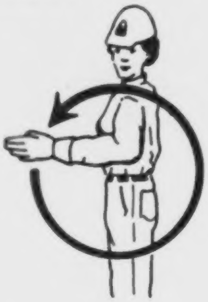
FIGURE 83



OBJECTIVE 8 **Given pictures, differentiate between hand signals used to maneuver vehicles.** (Assignment Sheet 1)

- Move

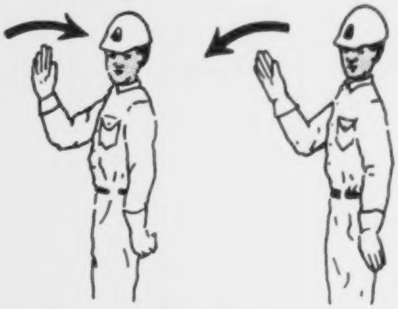
FIGURE 84



Extend forearm forward and rotate in direction of motion.

- Move backward or forward

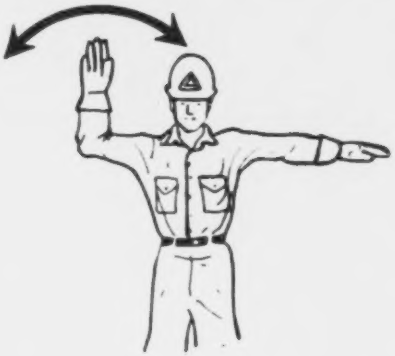
FIGURE 85



Extend arm forward, forearm vertical, hand open, palm forward; move arm in direction of motion.

- Turn while moving

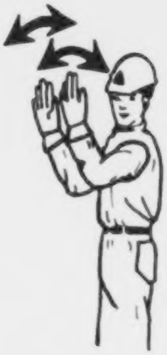
FIGURE 86



One forearm vertical, palm facing forward, move arm back and forth to indicate movement; other arm extended, palm down, point in direction of turn.

- Straighten out

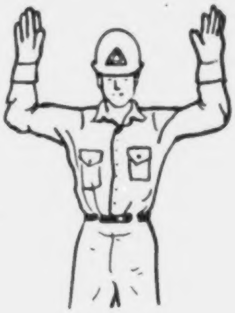
FIGURE 87



Both arms extended forward, forearms vertical, hands open, one palm facing out and the other facing in; move forearms forward and back.

- Stop

FIGURE 88



Hold both arms to the side, forearms vertical, hands open, palms facing out.

INSTRUCTIONS TO SIGNAL PERSON

1. Only one person will be signal person.

2. Make sure the operator can see you and is able to acknowledge the signal given.

3. Signal person must watch the load — the operator is watching you.

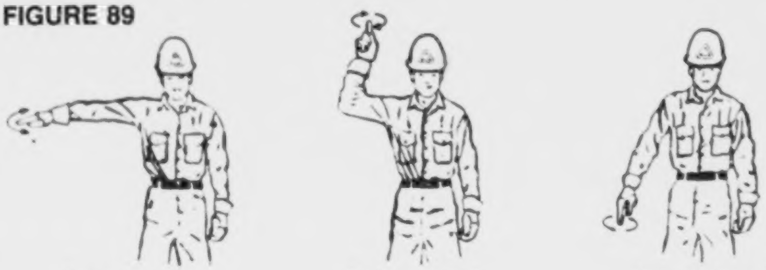
4. Never raise or lower load over other workers; warn them to keep out of the way.

WATCH FOR OVERHEAD LINES OR OTHER OBSTRUCTIONS

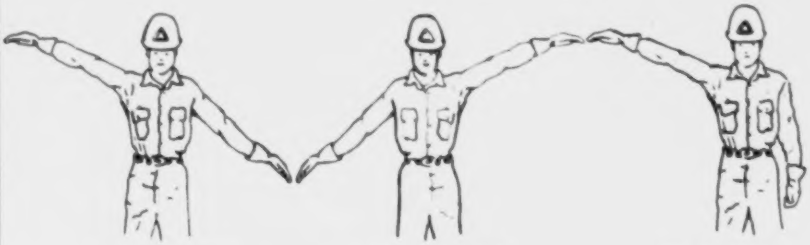
OBJECTIVE 9

Choose, from a group of alternatives, the proper hand signals used to direct the operation of forklifts. (Assignment Sheet 2)

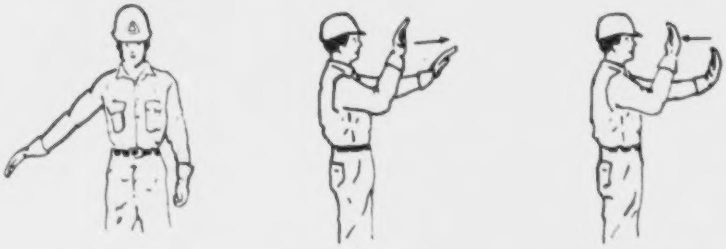
FIGURE 89



Stop Raise Load Lower Load



Tilt forks right Tilt forks left Tilt forks up



Tilt forks down Move load backward Move load forward

ASSIGNMENT SHEET 1

COMMON TOOLS AND EQUIPMENT — D 1

Name ______________________ Score __________

OBJECTIVE 8

Given pictures, differentiate between hand signals used to maneuver vehicles.

INTRODUCTION

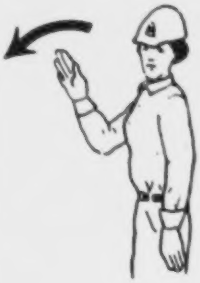
Construction workers who use various types of vehicles must know how to use hand signals for maneuvering those vehicles to avoid injuries and damage. By knowing how to use the proper hand signals, you may help another worker avoid a dangerous situation or serious accident.

INSTRUCTIONS

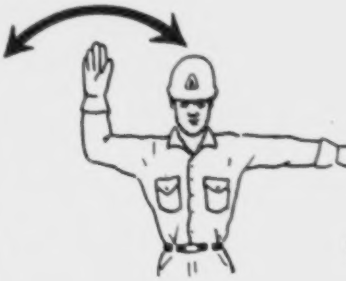
Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

Part 1 — Circle the letter below the picture that best represents the hand signal stated.

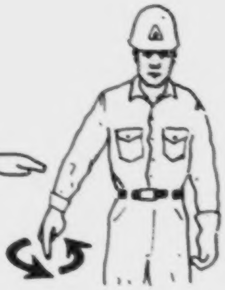
1. Turn while moving



A

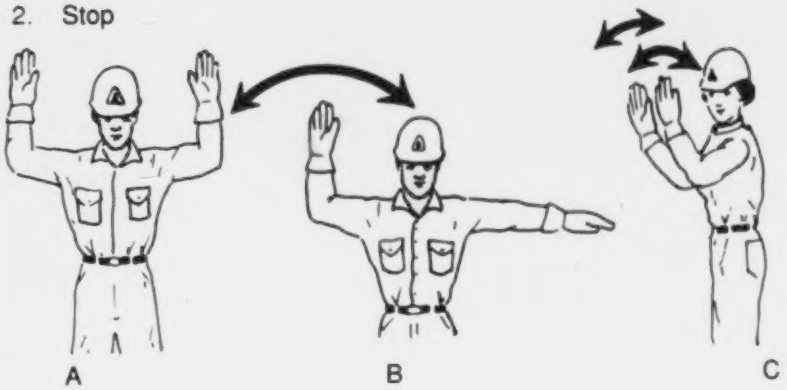


B

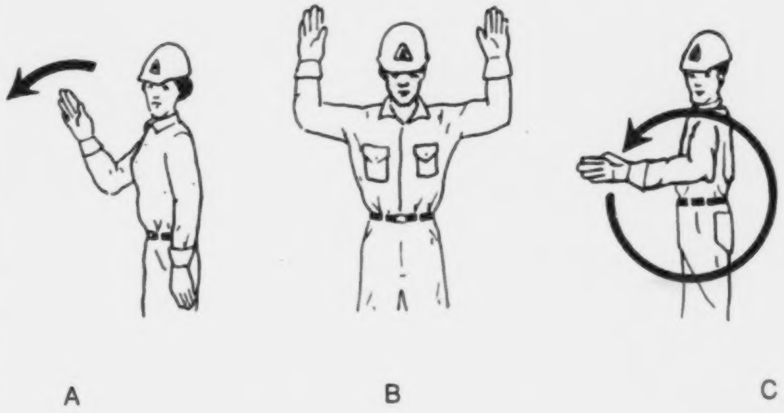


C

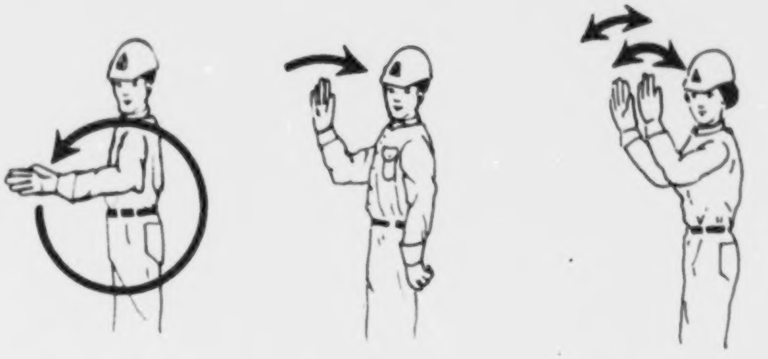
2. Stop



3. Move

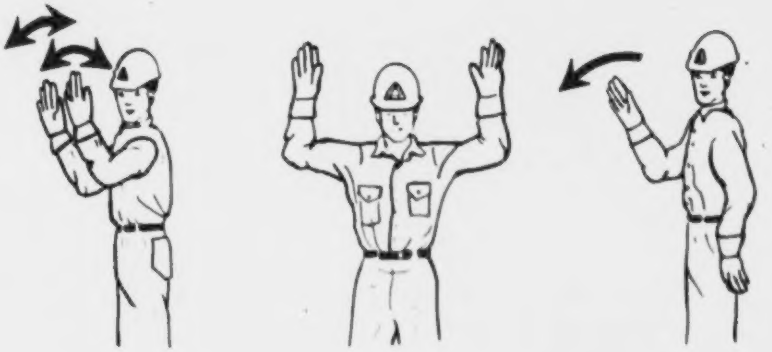


4. Move backward



A B C

5. Straighten out

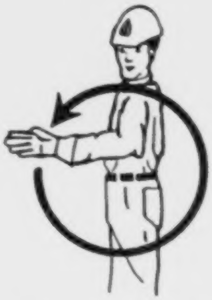


A B C

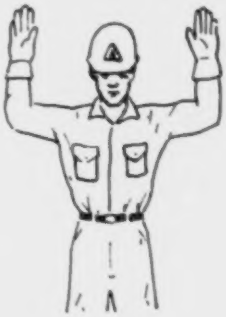
DIRECTIONS

Part 2 — Circle the letter corresponding to the hand signal shown in each picture.

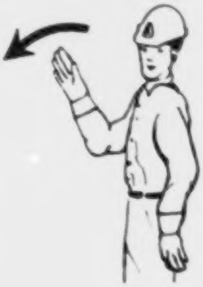
1. A. Turn while moving
   B. Stop
   C. Move
   D. Hurry



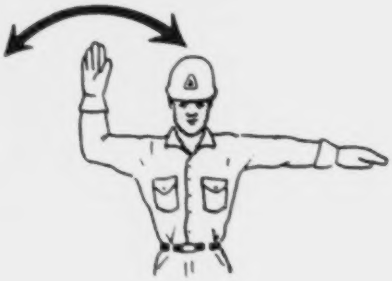
2. A. Move
   B. Stop
   C. Straighten out
   D. Turn



3. A. Stop
   B. Straighten out
   C. Move backward
   D. Move forward



4. A. Tilt
   B. Turn while moving
   C. Move
   D. Straighten out

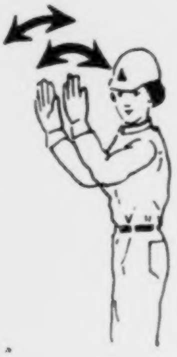


5. A. Move quickly

   B. Move forward

   C. Straighten out

   D. Move backward



ASSIGNMENT SHEET 2

COMMON TOOLS AND EQUIPMENT

D 1

Name ______________________________ Score __________

OBJECTIVE 9

Choose, from a group of alternatives, the proper hand signals used to direct the operation of forklifts.

INTRODUCTION

You should become familiar with hand signals before you need to give or receive them on the job. Practice hand signals until you are proficient at giving and receiving them.

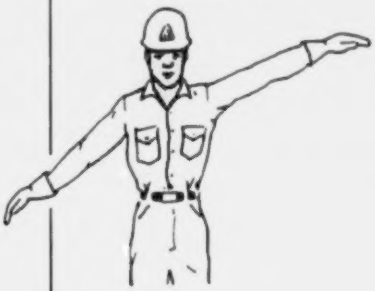
INSTRUCTIONS

Circle the letter below the picture that best represents the hand signal stated.

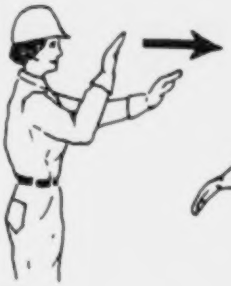
Functional Reading Skills
- Follow written instructions
- Interpret graphics and symbols

Job Acquisition/ Development Skills
- Master specific job task/procedure

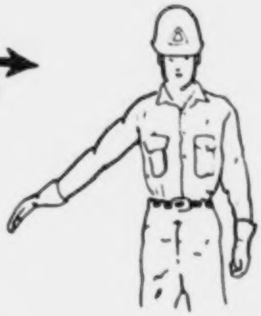
1. Tilt forks down



A

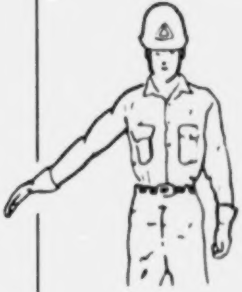


B

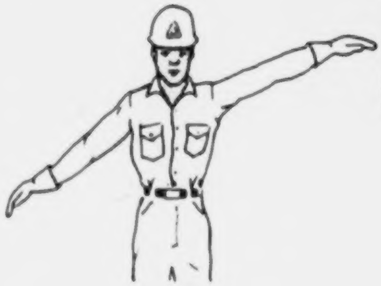


C

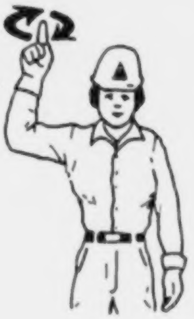
2. Tilt forks left



A

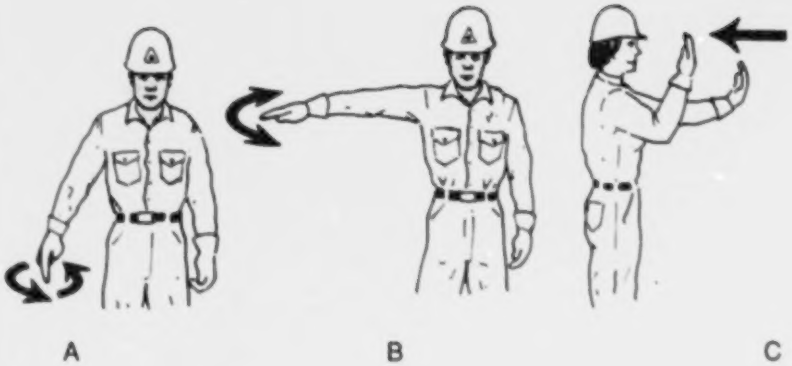


B

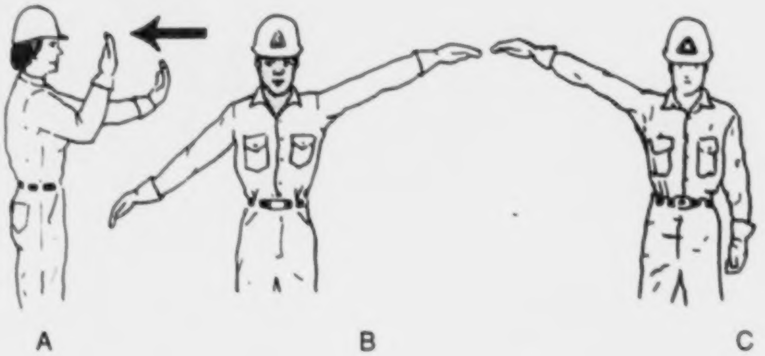


C

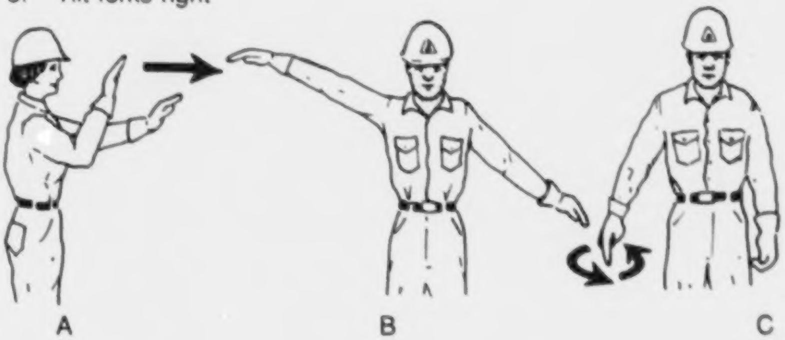
3. Lower load



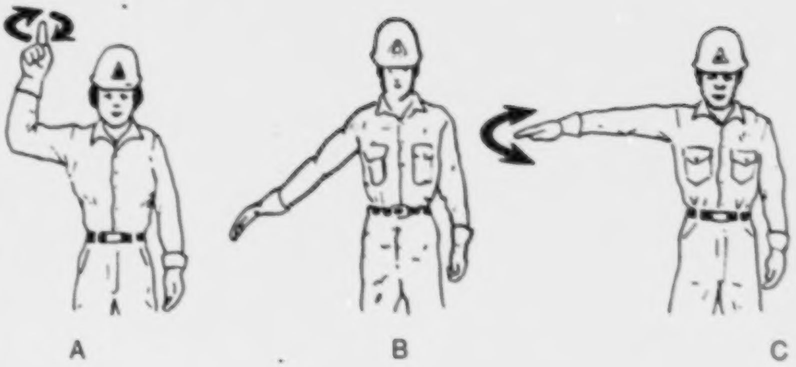
4. Move load forward



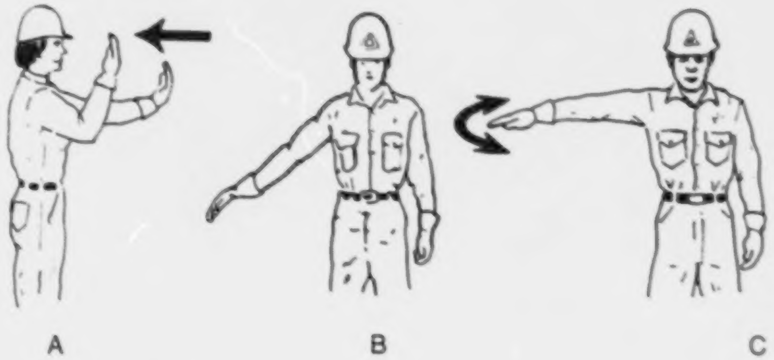
5. Tilt forks right



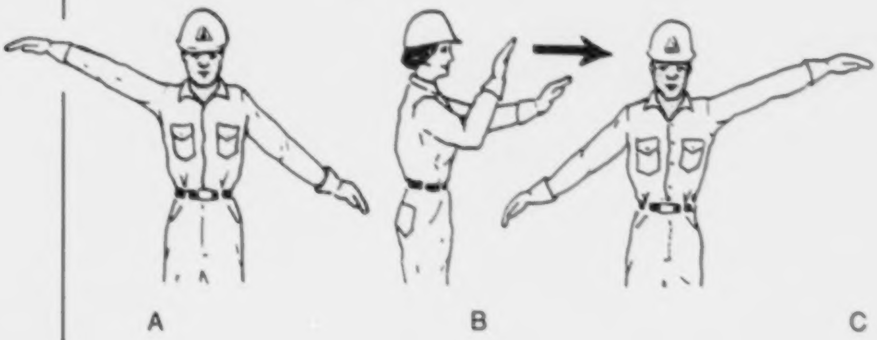
6. Raise load



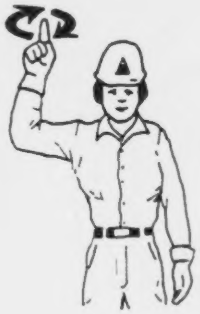
7. Stop



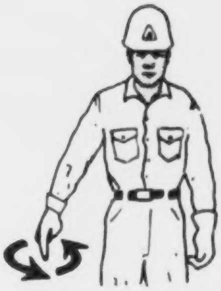
8. Move load backward



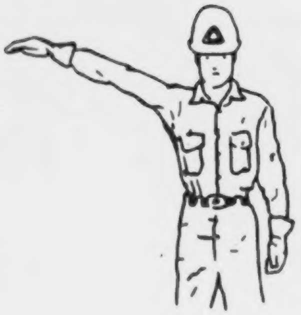
9. Tilt forks up



A



B



C

ASSIGNMENT ANSWERS

COMMON TOOLS AND EQUIPMENT

D 1

ASSIGNMENT SHEET 1

Part 1

1. B
2. A
3. C
4. B
5. A

Part 2

1. C
2. B
3. D
4. B
5. C

ASSIGNMENT SHEET 2

1. C
2. B
3. A
4. A
5. B
6. A
7. C
8. B
9. C

WRITTEN TEST

COMMON TOOLS AND EQUIPMENT

D 1

Name ______________________ Score __________

OBJECTIVE 1

Given a list of terms associated with construction tools and equipment, match them to their correct definitions. Write the letter that corresponds to the most correct answer.

_____ 1. A device used to guide a saw at the proper angle for cutting a joint is a/an

- a. protractor
- b. push stick
- c. miter box
- d. angle guider

_____ 2. A unit that can collect and store both wet and dry substances is called a/an

- a. nibbler vacuum cleaner
- b. wet/dry vacuum cleaner
- c. suction type vacuum
- d. wet/dry air compressor

_____ 3. What is the best term to describe air-powered tools?

- a. Air valve tools
- b. Watts tools
- c. Power tools
- d. Pneumatic tools

_____ 4. Which of the following devices can be used to transport concrete around construction sites?

- a. Power buggy
- b. Power shear
- c. Booster
- d. Alternator

May be photocopied for student use.

______ 5. The sharp, violent reaction of a tool as it rejects the material being forced into it is called a/an

a. kickback
b. kicker
c. jerk reaction
d. rejection kick

______ 6. What is the safety device used to push material through cutters to protect fingers from being cut?

a. Booster
b. Safety pole
c. Push stick
d. Safety rod

______ 7. A unit of measure for electrical power is called a/an

a. electrical ratio
b. volt
c. pressure
d. watt

______ 8. A tool that can be used to drill holes through hard concrete is a

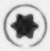
a. nibbler
b. rotary hammer
c. power shear
d. power buggy

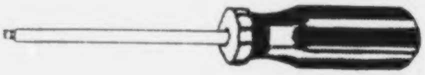
May be photocopied for student use

OBJECTIVE 2

Given drawings, match hand tools with their identities. Circle the corresponding letter that best identifies the pictured tool above.

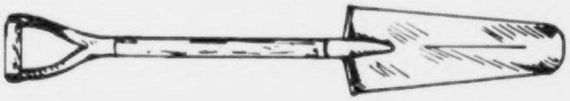
_____ 1.





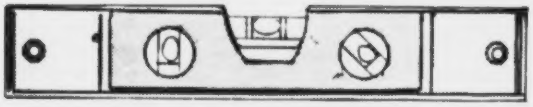
a. torx head screwdriver
b. square head screwdriver
c. star head screwdriver
d. phillips head screwdriver

_____ 2.



a. D-handled square point spade
b. sharpshooter
c. mattock
d. utility spade

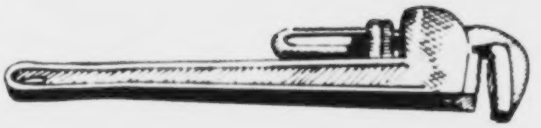
_____ 3.



a. line level
b. mason's level
c. box square
d. torpedo level

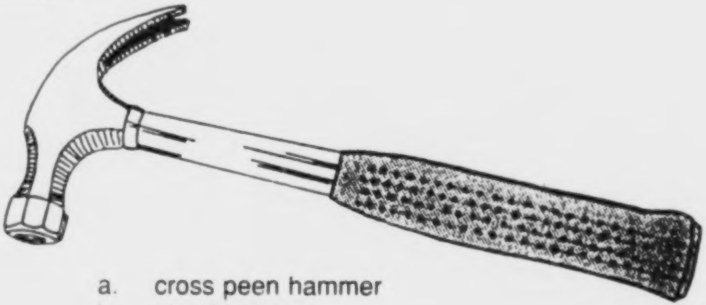
May be photocopied for student use.

_____ 4.



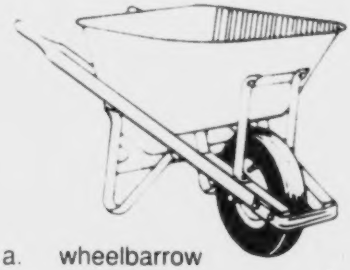
a. spud wrench
b. adjustable wrench
c. clean wrench
d. pipe wrench

_____ 5.



a. cross peen hammer
b. pipe hammer
c. claw hammer
d. ball peen hammer

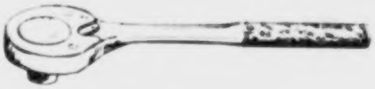
_____ 6.



a. wheelbarrow
b. power buggy
c. utility cart
d. uni-cart

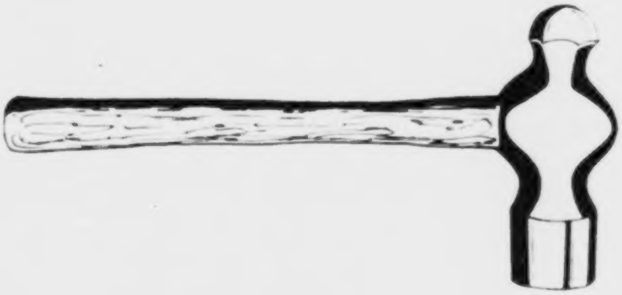
May be photocopied for student use

_____ 7.



a. torx wrench and adapter
b. ratchet wrench
c. toe bar with connector
d. pipe wrench

_____ 8.



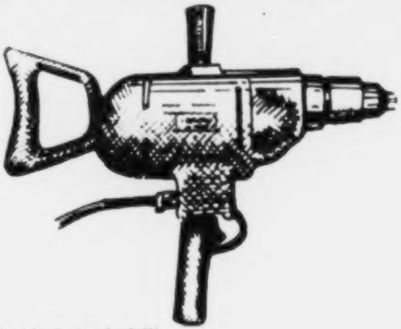
a. ball peen hammer
b. claw hammer
c. cross peen hammer
d. sledge hammer

May be photocopied for student use.

OBJECTIVE 3

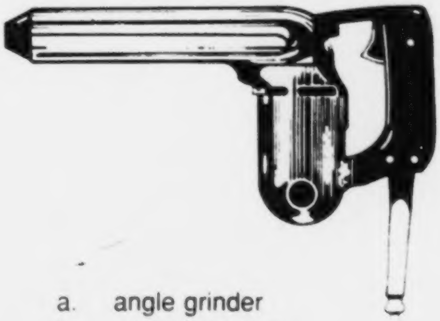
Given alternatives, identify common power tools and equipment used within the construction industry.

_____ 1.



a. ¼-inch hand drill
b. ½-inch hand drill
c. band saw
d. circular drill

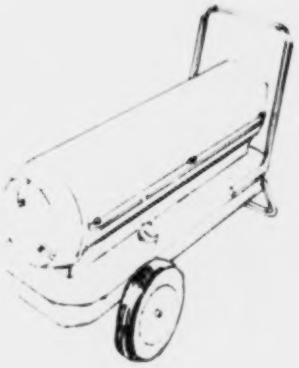
_____ 2.



a. angle grinder
b. rotary hammer
c. power pin hammer
d. electric percussion hammer

May be photocopied for student use.

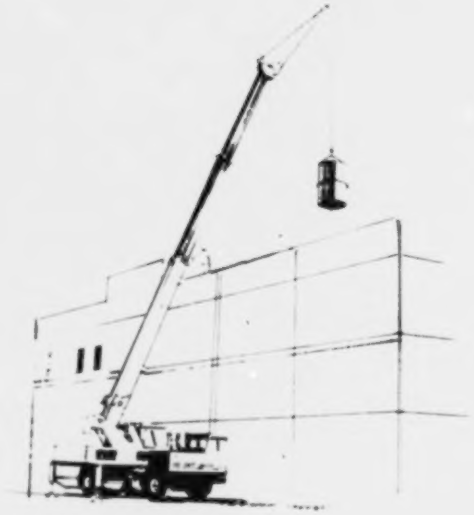
_____ 3.



a. space heater
b. alternator
c. portable pavement breaker
d. power lift

May be photocopied for student use.

_____ 4.



a. tower crane
b. cherrypicker crane
c. hydraulic truck crane
d. loft crane

OBJECTIVE 4 **Given a list of terms associated with leveling instruments, match them to their correct definitions.**

_____ 1. Within the construction industry. which of the following terms is used to describe the difference between elevations of two points on a slope?

a. Dip
b. Fall
c. Elevational drop
d. Grade level differential

May be photocopied for student use

_____ 2. Which of the following terms describes a tool, attached to a string, used to set and check the vertical or perpendicular of a surface?

   a. Level
   b. Bench mark
   c. Transit
   d. Plumb bob

_____ 3. A permanent point of known elevation is called a

   a. model point
   b. base elevation
   c. stadia
   d. bench mark

_____ 4. What is the best term used to describe a plot of ground on which a project is to be constructed?

   a. Site
   b. Bench mark
   c. Construction plot
   d. Grade line point

_____ 5. The reference lines in the telescope of leveling instruments are called

   a. reference marks
   b. cross hairs
   c. target lines
   d. cross references

_____ 6. A rod used with leveling instruments and marked with graduations upward from zero is called a

   a. plumb bob rod
   b. grade rod
   c. leveling rod
   d. bench rod

May be photocopied for student use.

_____ 7. Which of the following terms represents the stake driven into the ground to mark the proposed grade?

a. Leveling stake
b. Ground level stake
c. Grade stake
d. Zero level stake

_____ 8. The elevation of the finished floor in relation to the bench mark is best referred to as the

a. grade level
b. finish-floor height
c. finish-floor width
d. bench mark

_____ 9. A very precise instrument used to establish straight lines and to measure horizontal and vertical angles is called a

a. transit
b. level
c. parallax box
d. builder's level

_____10. A device used primarily for establishing grade levels and determining elevations is called a

a. bench marker
b. plumb bob
c. parallax
d. level

OBJECTIVE 5

Given alternatives, match each type of leveling instrument to its use.

_____ 1. A builder's level can be used to

a. measure vertical angles
b. lay out boundaries and building lines
c. transfer elevations from one point to another
d. all the above

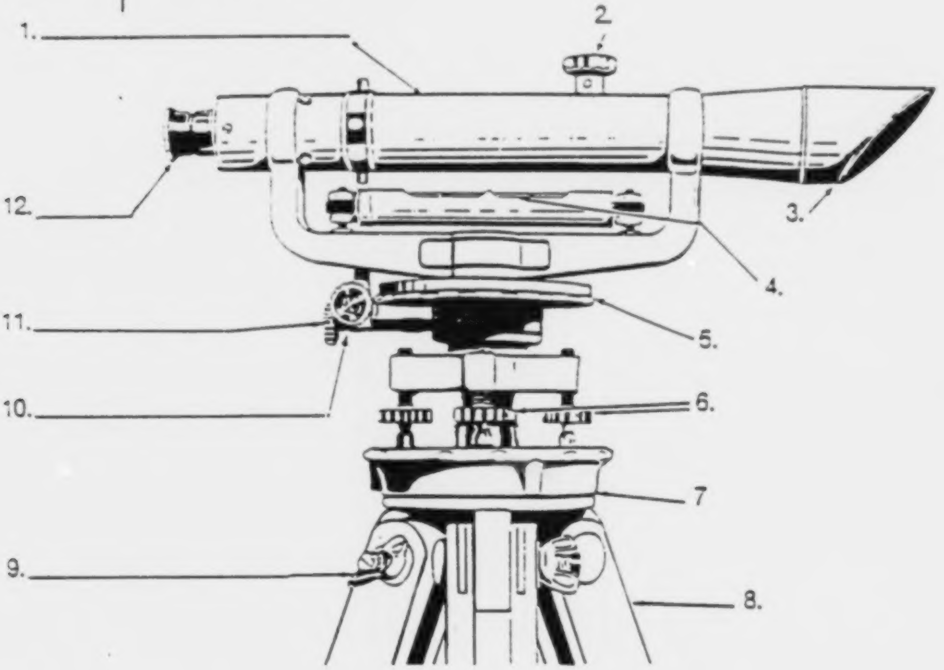
May be photocopied for student use

_____ 2. An engineer's transit can be used to

a. measure elevations
b. lay out boundaries
c. establish grades
d. all the above

OBJECTIVE 6 **Given pictures of leveling instruments, identify operator controls and major elements by name.** Use the figure below to identify the numbered elements in questions 1-4.

Builder's Level



_____ 1. What is the name of the adjustment identified with the number 2?

a. Focusing screw
b. Fine adjustment screw
c. Leveling screws
d. Degree scale

May be photocopied for student use.

_____ 2. Which of the following terms best describes the element identified by the number 6?

a. Degree scale
b. Focusing screw
c. Leveling screws
d. Head plate

_____ 3. The adjustment identified by the number 10 is the

a. head plate
b. fine adjustment screw
c. focusing screws
d. leveling screws

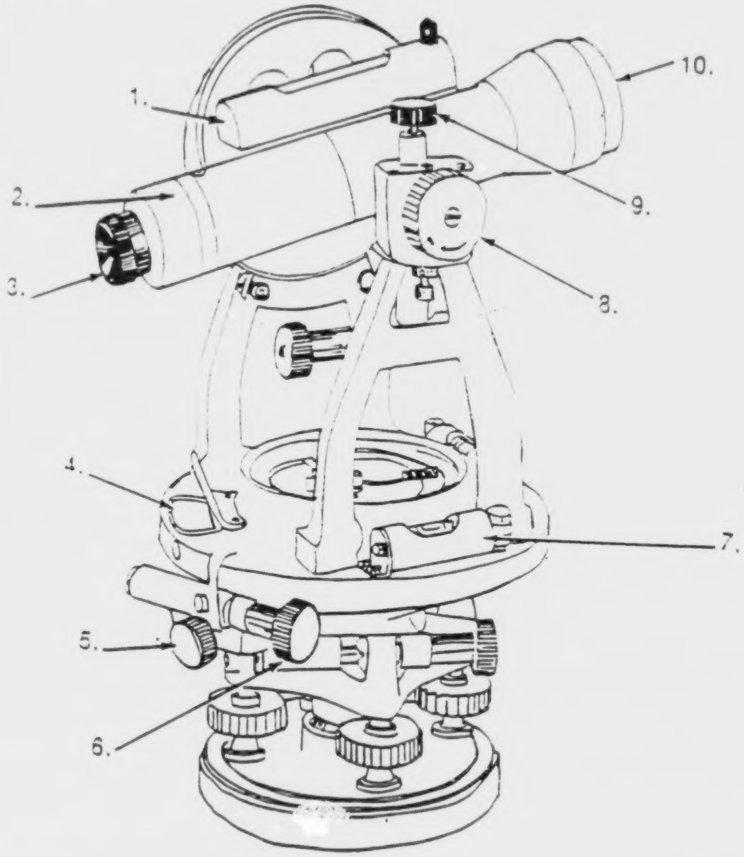
_____ 4. Which of the following elements is designated by the number 8?

a. Head plate
b. Support staff
c. Clamp
d. Tripod

May be photocopied for student use

Use the figure below to identify the numbered elements in questions 5 - 7.

TRANSIT



_____ 5. What is the name of the transit element designated by the number 3?

a. Eyepiece
b. Telescope
c. Focusing pinion
d. Level vial

May be photocopied for student use.

_____ 6. What is the name of the transit element identified by the number 7?

a. Plate level vial
b. Telescope level vial
c. Focusing pinion
d. Upper-motion tangent screw

_____ 7. The term that best describes the element identified by the number 10 is

a. telescope clamp screw
b. objective lens
c. output lens
d. eyepiece

OBJECTIVE 7 · **Choose the proper guidelines for the safe handling of leveling instruments.**

1. Which of the following procedures is correct when handling leveling instruments?

_____ a. Remove the lenses when transporting the instrument.
_____ b. Tighten the leveling screws before returning the instrument to its case.
_____ c. Carry the tripod under your arm with the instrument in front of you.
_____ d. Grasp the telescope barrel when removing the instrument from its case.

2. What is recommended to be used to clean the instrument's lenses?

_____ a. fingertips
_____ b. wet paper towel
_____ c. cloth soaked in oil
_____ d. soft tissue only

May be photocopied for student use

NOTE: Objectives 8 and 9 are evaluated on assignment sheets in this unit. If you have not completed these components, see your instructor.

May be photocopied for student use.

WRITTEN TEST ANSWERS

COMMON TOOLS AND EQUIPMENT

D 1

OBJECTIVE 1	1. c	5. a
	2. b	6. c
	3. d	7. d
	4. a	8. d
OBJECTIVE 2	1. a	5. c
	2. b	6. a
	3. d	7. b
	4. d	8. a
OBJECTIVE 3	1. b	3. a
	2. d	4. c
OBJECTIVE 4	1. b	6. c
	2. d	7. c
	3. d	8. b
	4. a	9. a
	5. b	10. d
OBJECTIVE 5	1. c	
	2. d	

OBJECTIVE 6	1. a	5. a
	2. c	6. a
	3. b	7. b
	4. d	
OBJECTIVE 7	1. c	
	2. d	
OBJECTIVE 4-5	Evaluated through the use of assignment sheets.	

OBJECTIVE SHEET

LADDERS AND SCAFFOLDS

D 2

INTRODUCTION

Ladders and scaffolds are used to allow workers access to elevated areas. Scaffolds may also be used to support building material or form work. This unit describes the various types and parts of ladders and scaffolds and emphasizes the need for their safe use.

UNIT OBJECTIVE

After completing this unit, the student will be able to demonstrate these competencies by completing the job sheet and written test with a minimum of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to show the ability to:

1. Given a list of terms associated with ladders and scaffolds, match them to their correct definitions.
2. Given drawings, match ladders and scaffold types to their identities.
3. Given pictures, choose the proper name for scaffold parts.
4. Choose, from a group of alternatives, the proper safety rules in the use of ladders and scaffolds.
5. Using all safety rules, construct a section of scaffolds. (Job Sheet)

PREPARATION

- Review unit and plan presentation
- Study the specific objectives to determine the order in which you will present the objectives. Decide whether or not you wish to add additional objectives.
- Review teaching suggestions given in the Delivery section and plan classroom activities.
- Plan presentation to take advantage of student learning styles and to accommodate students with special needs.
- Order films, videotapes, and other media to supplement instruction of this unit. See ordering information in the Suggested Resources section. Include in your selection media that demonstrates job sheet skills. Videotape your own procedures if unable to obtain suitable media.
- Obtain competency profiles for this unit.

  NOTE: Competency profiles for this book are available from the Curriculum and Instructional Materials Center, Oklahoma State Department of Vocational and Technical Education, 1500 West Seventh Avenue, Stillwater, Oklahoma 74074-4364, (800) 522-5810, ext. 589 in state; (800) 654-4502 out of state.

DELIVERY

Objective 1: Given a list of terms associated with ladders and scaffolds, match them to their correct definitions.

- Use the Information Sheet to discuss terms and definitions associated with ladders and scaffolds.
- Point out the importance of defining terms for common understanding.

Objective 2: Given drawings, match ladders and scaffold types to their identities.

- Take a field trip to a construction site to view use of ladders and scaffolds.
- Show the ladders and scaffolds within your school or work area and discuss the various types.

Objective 3: Given pictures, choose the proper name for scaffold parts.

- Hand out manufacturer's catalogs and discuss the terms used to describe scaffold parts. Explain that scaffold vendors may use slightly different terms to describe parts.

Objective 4: Choose, from a group of alternatives, the proper safety rules in the use of ladders and scaffolds.

- Show safety videos.
- Show students a ladder and discuss the importance of inspecting the ladder for safe condition.
- Use Transparencies 1 and 2 to discuss the dangers and safety rules in using ladders.

Objective 5: Using all safety rules, construct a section of scaffolds. (Job Sheet)

- Assign students to complete the Job Sheet using all safety rules.

EVALUATION

Administer Pretest

- Administer the Pretest.
- Use the Pretest results to assess student competencies, considering the results as you prepare your presentation for each objective.

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Written Test

- Give the written test.

  NOTE: The written test may be given in sections if desired.

- Evaluate class members on assignment sheet activities if this was not previously done.

Skill Test

- Give the practical tests. Evaluate the tests on forms provided.
- Reteach and retest as required.
- Complete the appropriate section of the competency profiles.
- Review individual and group performance in order to evaluate teaching methods.
- Adjust the scope, sequence, or instructional approaches for addition lessons as required.

SUGGESTED RESOURCES

AGC RESOURCES

- *Ladder Safety*. AGC of America, (202) 393-2040, ext. 287. Video.
- *Success at the Top*. AGC of America, (202) 393-2040, ext. 287. Video.
- *Working Safely on Scaffolds*. AGC of America, (202) 393-2040, ext. 287. Video.

Electronic Media

- *Ladders and Scaffolding*. Career Aids, Inc., 20417 Nordhoff Street, Dept. K4, Chatsworth, CA 91311.

UNIT REFERENCES

- *Scaffolding and Equipment*, Bil-Jac Inc., 595 E. Lugbill Rd., Archbold, OH 43502.

- Toenjes. Leonard P. *Building Trades Dictionary*, American Technical Publishers, Inc., Homewood, IL. 1989.
- Willey, Al. *Residential Carpentry*. Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center, and The Associated General Contractors of America: Stillwater, OK, 1993.

INFORMATION SHEET

LADDERS AND SCAFFOLDS

D 2

OBJECTIVE 1

Given a list of terms associated with ladders and scaffolds, match them to their correct definitions.

- **caster** — wheel used to support scaffold; mounted in a swivel frame and furnished with brakes
- **cleat** — board nailed to the bottom of the scaffold planks to hold them together and to keep them from sliding off the end frames
- **end frame** — the end panels of metal scaffolds
- **insert/fastener/coupling pin** — metal rod used to link scaffold frames
- **job-built scaffold** — scaffold that is constructed and set up on the site where it is to be used
- **mudpads** — heavy pieces of wood nailed together to form pads about 18 inches square; used on ground to support scaffolds
- **mud sills** — continuous timber placed on the ground to support scaffolds
- **OSHA (Occupational Safety and Health Act)** — federal legislation designed to ensure safe and sanitary working conditions for employees
- **outriggers** — additional bracing to give scaffolds broader bases for support
- **putlog** — short member on which the scaffold planks or platform is laid and attached
- **rolling tower** — scaffolding assembled with casters to ease relocation

- **safety shoe** — safety device on bottom of ladders; used to prevent ladder heel from sliding

- **safety rails** — guardrail attached on scaffolds 42 inches high and midway between 42 inches and toeboard

- **scaffold jacks** — angle-shaped devices manufactured to fasten on forms in pairs to support a platform for workers and materials

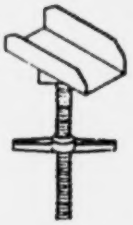
- **standing or working level** — the maximum height that a ladder manufacturer recommends workers ascend safely

- **swinging scaffold (stage)** — type of scaffold normally hung from top of a structure for which it is not practical to build a scaffold

- **tagline** — rope used to guide or steady a load being hoisted

- **toeboard** — four-inch guardrail attached ¼ inch above scaffold platform to prevent tools and material from falling from scaffold

- **"u" or "j" head** — devices attached to the top of scaffolding to provide attachment of shoring members



- **walkboards** — often called catwalks, provide workers with a safe work platform on scaffolds

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votech

OBJECTIVE 2 **Given drawings, match ladders and scaffold types to their identities.**

- Ladders

  Ladders may be wood, metal, or fiberglass. Maintain caution when using metal ladders near any electrical wires or equipment.

  1. Stepladder 2. Extension 3. Single, straight

FIGURE 1

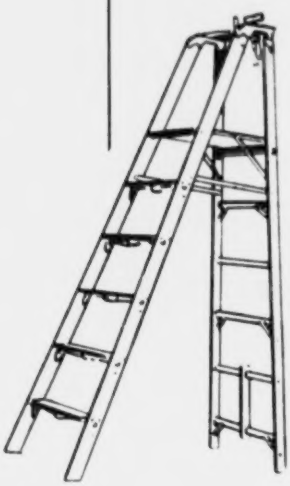


FIGURE 2

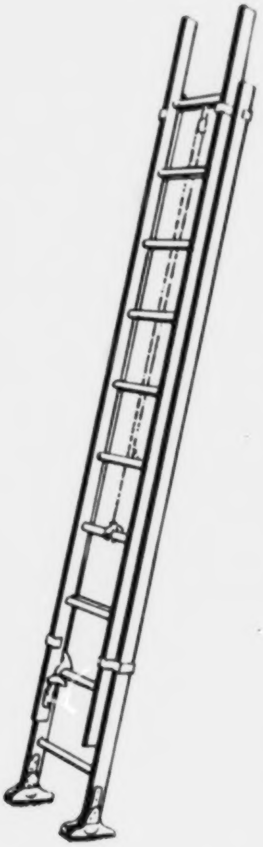
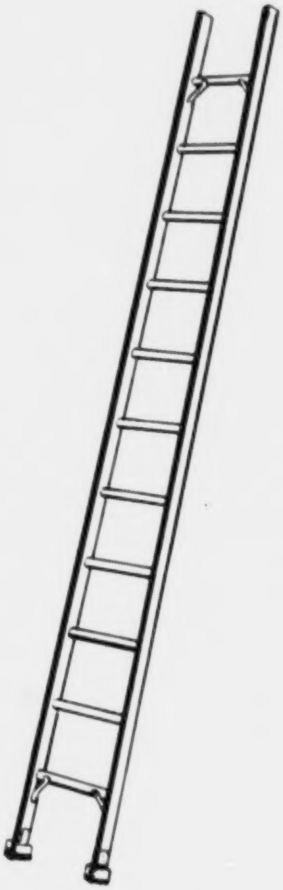


FIGURE 3



Ladders are classified by their weight handling capacity or working load. The chart below is one ladder manufacturer's specifications for each ladder type.

TYPE	DUTY RATING	WORKING LOAD
Type III	Household	200 lbs.
Type II	Commercial	225 lbs.
Type I	Heavy Duty	250 lbs.
Type IA	Ex. Heavy Duty	300 lbs.

NOTE: Be sure to consider the ladder working load specifications when purchasing or using ladders.

- Scaffolds

  Scaffolds may be wood, steel, or aluminum; they may be prefabricated or built at the job site.

  — Prefabricated

FIGURE 4

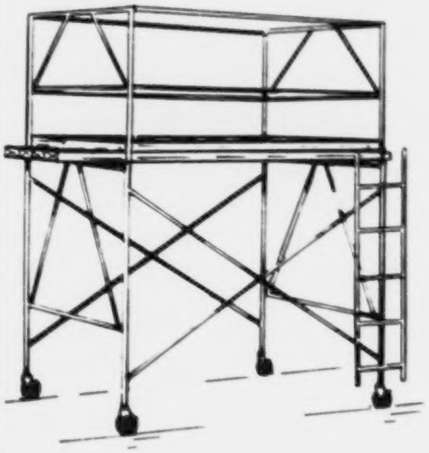


FIGURE 5

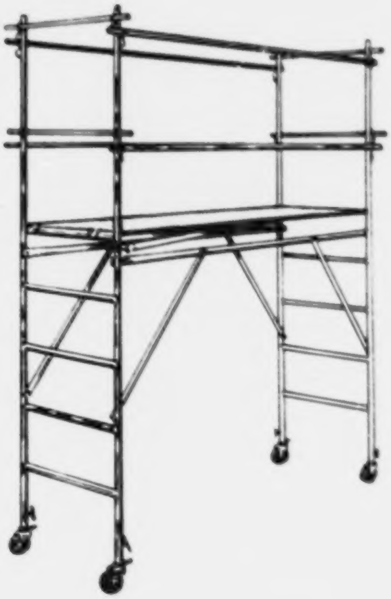
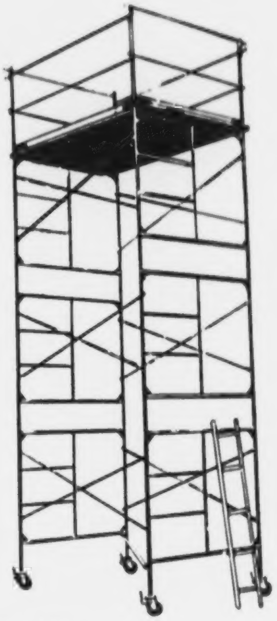


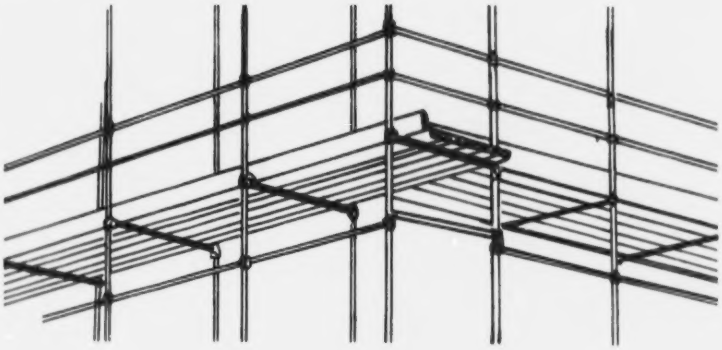
FIGURE 6



— Tubular, locking

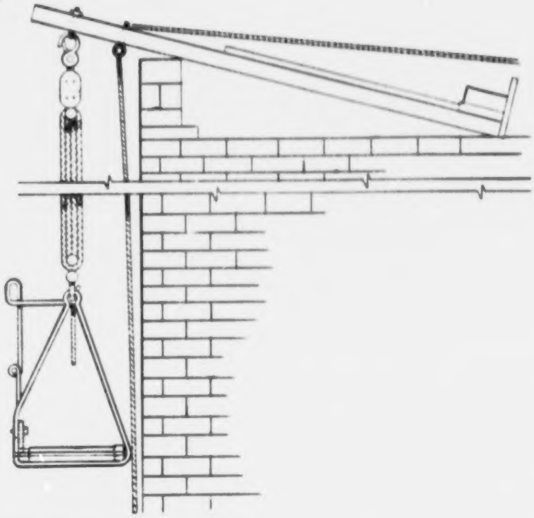
This type of scaffolding can be used with curved or irregular shapes such as cylinders, spheres, and pyramids.

FIGURE 7



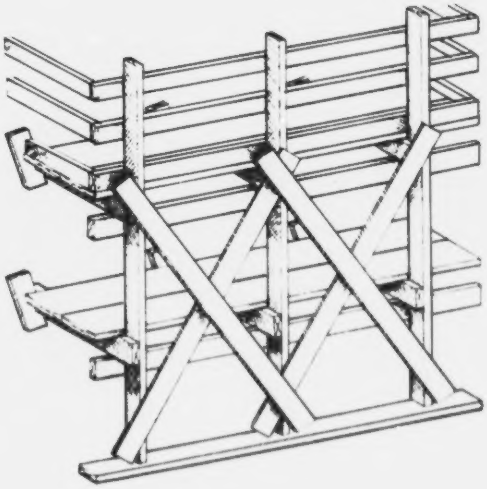
— Swinging

FIGURE 8



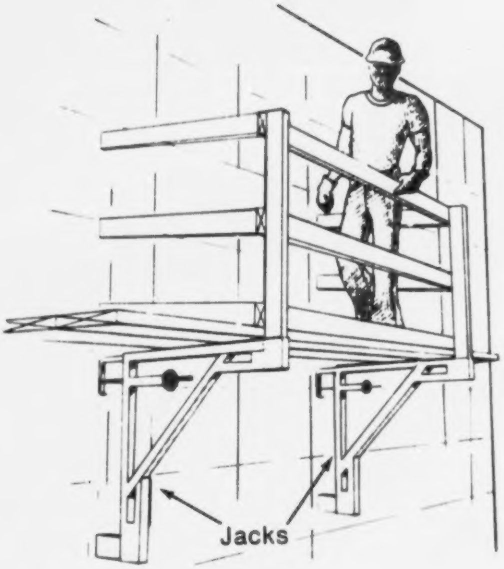
— Single-pole (Job-built)

FIGURE 9



- Scaffold jacks with platform

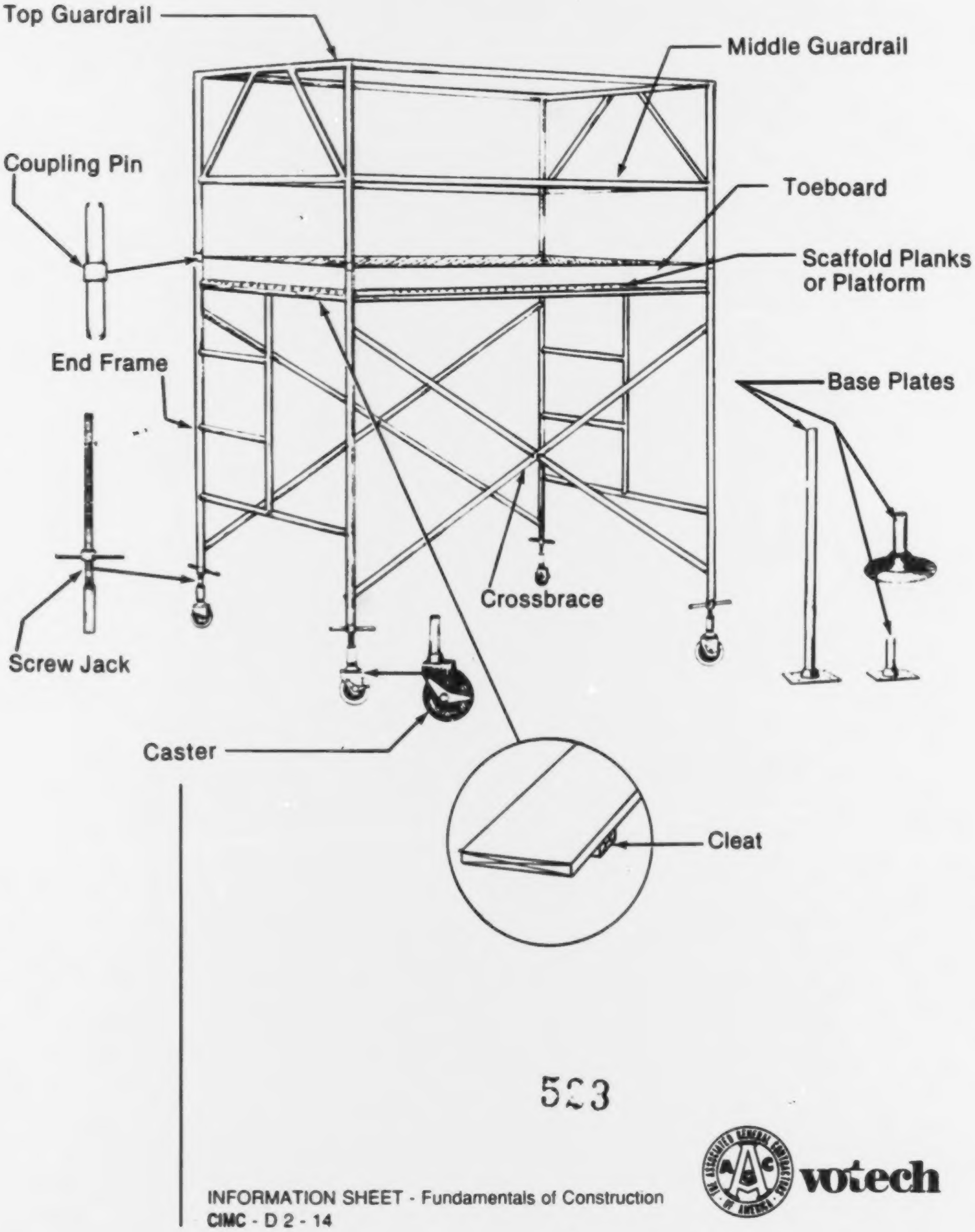
FIGURE 10



OBJECTIVE 3 **Given pictures, choose the proper name for scaffold parts.**

NOTE: OSHA requires a top guardrail 42 inches high, a midrail halfway between top guardrail and toeboard, and a toeboard just above the scaffold plank or platform.

FIGURE 11


Top Guardrail
Middle Guardrail
Coupling Pin
Toeboard
Scaffold Planks or Platform
End Frame
Base Plates
Crossbrace
Screw Jack
Caster
Cleat

OBJECTIVE 4 **Choose, from a group of alternatives, the proper safety rules in the use of ladders and scaffolds.**

- Scaffolding
  - Inspect all scaffold parts before assembly.
  - Always check for electrical wires; deenergize them before erecting metal scaffolding in the vicinity.
  - Be sure that casters are locked on rolling scaffolds before ascending.
  - Don't propel or move a scaffold while personnel are on it.
  - Do not work on scaffolds during storms, high winds, or when scaffolds are covered with ice or snow.
  - Tie off scaffolds about every 25 feet when they are built several section high and 30 horizontally. Check scaffold manufacturer specifications for specifics.
  - Ensure scaffolds are level and plumb.
  - Do not overload scaffolds.
  - Do not climb on cross braces.
  - Be sure that scaffolds are equipped with top rail (42 inches high), midrail, and toeboard.
  - Be sure that scaffold boards have cleats when necessary.
  - Use safety belts, harnesses, and nets as required.
  - Provide adequate mudsills and/or base plates.
  - Ensure lumber for scaffold planks overlap the scaffold end frames.

- Ladders

  — Fully spread and lock any stepladder before using.

  — Do not use ladders that are not equipped with safety shoes.

  — Never overreach from a ladder.

  — Never work from the top step or rung of any ladder.

  — Below is a table of manufacturer's recommendations for the maximum height workers should ascend on ladders. Workers should always consult manufacturer's specifications.

STEP LADDER		EXTENSION LADDERS	
Size	Highest Standing Level	Size	Maximum Working Length
4 Ft.	1 Ft. 11 In.	16 Ft.	13 Ft.
5 Ft.	2 Ft. 11 In.	20 Ft.	17 Ft.
6 Ft.	3 Ft. 10 In.	24 Ft.	21 Ft.
8 Ft.	5 Ft. 9 In.	28 Ft.	25 Ft.
10 Ft.	7 Ft. 8 In.	32 Ft.	29 Ft.
12 Ft.	9 Ft. 7 In.	36 Ft.	32 Ft.
		40 Ft.	36 Ft.
			40 Ft.

  — Never use a metal ladder when there is any possibility of contact with electrical conductors

  — Never use ladders in a horizontal position

  — Do not climb on a ladder that is occupied by someone else

  — Remove ladder when you are finished using it, and always remove and store ladder at end of workday

  — Evaluate the jobs in which the ladders will be used. Make sure the combined weight of user, tools, and materials does not exceed the specified working load.

- Before using your ladder, be sure to read and comply with ALL the labels, warnings, and instructions.
- Do not carry loads up a ladder. Ascend the ladder and pull the load up with a rope.

- Positioning ladders

Place ladders approximately one-quarter of their support length away from vertical plane of top support, and extension ladders at least 3 feet above top support (Figures 13 and 14)

EXAMPLES:

FIGURE 12

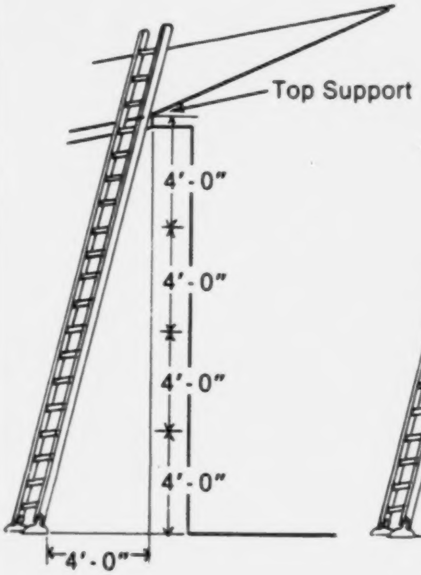
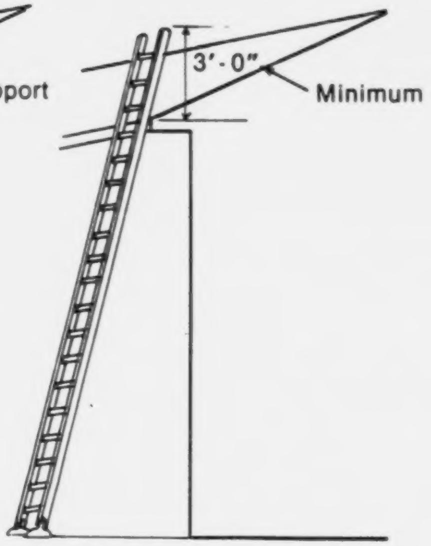


FIGURE 13

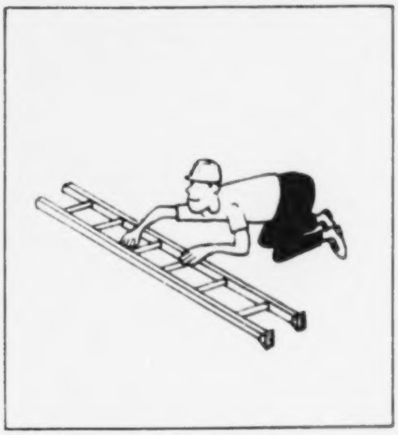


One-Fourth the Height of Top Support

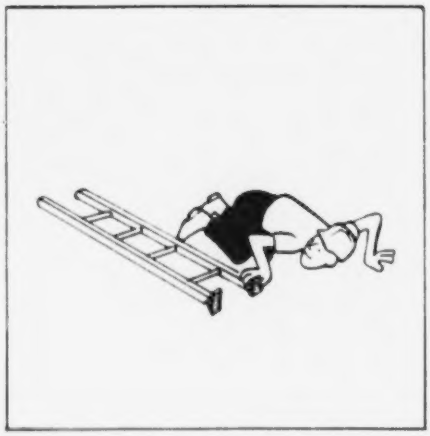
Secure ladders at both top and bottom to prevent displacement; brace long ladders at intermediate points to prevent spring

TM 1

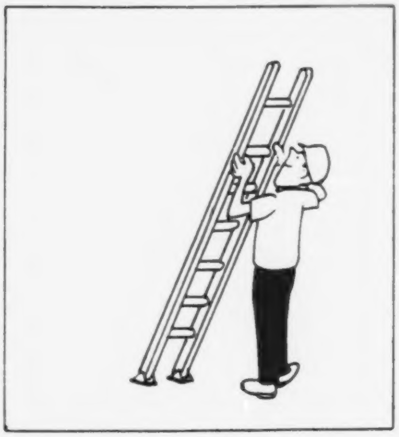
Ladder Safety



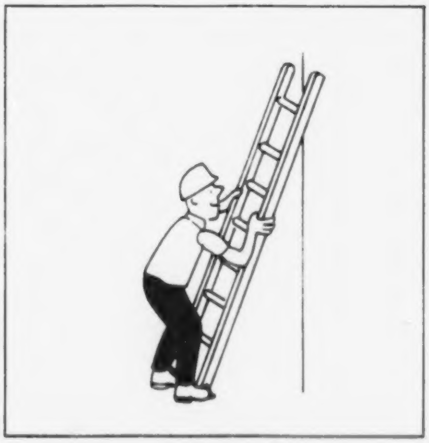
Check Condition



Check Safety Shoes

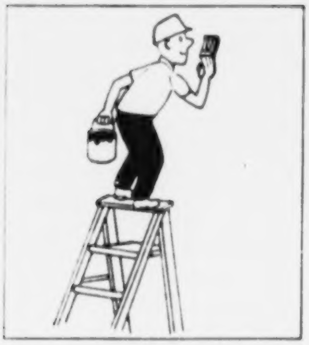


Check Load Limit

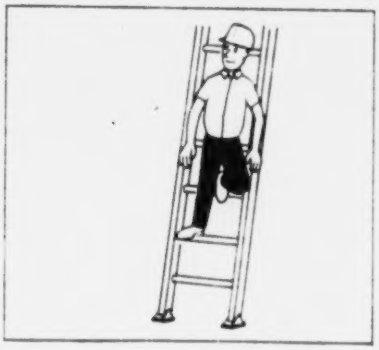


Place at Safe Angle

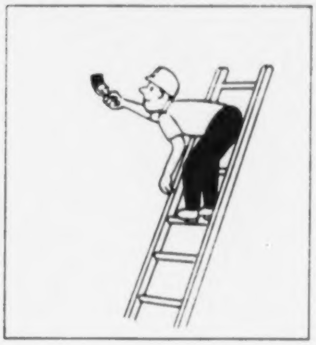
Ladder Danger



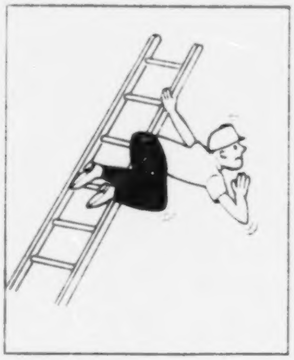
Standing on Top Rung



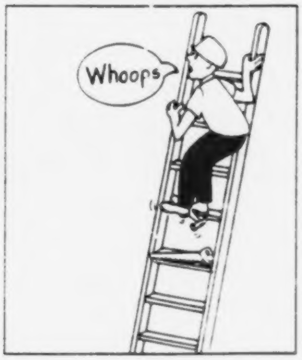
Facing Away from Ladder



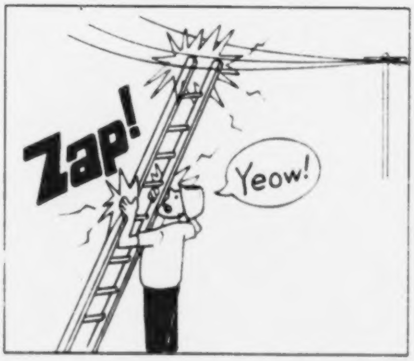
Reaching Too Far



Slipping From Slick, Oily Shoes



Slipping on Tools Left on Ladder



Contacting Electrical Lines with Metal Ladder

JOB SHEET 1

LADDERS AND SCAFFOLDS

D 2

Name ______________________________ **Score** __________

OBJECTIVE 1

Using all safety rules, construct a section of scaffolds.

TOOLS AND EQUIPMENT

- Goggles and hard hats
- Two end frames
- Two safety rail end frames
- Two crossbraces
- Two scaffold planks (w/safety cleats)
- Four guardrails
- Four toeboards
- Four coupling pins
- Four casters
- Ladder section
- Level

PROCEDURE

Functional Reading Skills
- Follow written instructions

General Science Skills
- Use scientific instruments

	Yes	No
1. Put on safety equipment.	___	___
2. Inspect scaffold parts to ensure personnel safety. Check for such defects as bent frames, cracked/split pins, or cracked casters.	___	___
3. Secure crossbraces to one end frame.	___	___
4. Secure crossbraces to second end frame.	___	___
5. Set scaffold planks on end frames, safety cleats facing down.	___	___
6. Ensure the scaffold is level and plumb.	___	___

Interactive Communication Skills
- Communicate with supervisors

Job Acquisition/ Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

Yes No

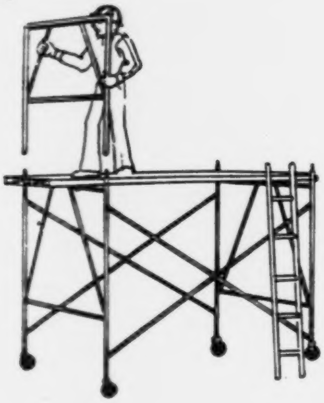
7. Set coupling pins in both end frames. ___ ___

8. Lift safety rail end frames to scaffold planks. ___ ___

CAUTION: ASK YOUR INSTRUCTOR OR SUPERVISOR TO REVIEW YOUR SCAFFOLD ASSEMBLY BEFORE ASCENDING SCAFFOLD.

9. Using a ladder, climb to scaffold planks, and set one safety rail end frame over coupling pins. ___ ___

FIGURE 14



10. Set second end frame over remaining coupling pins. ___ ___

11. Secure toeboards to uprights. ___ ___

12. Secure guardrails. ___ ___

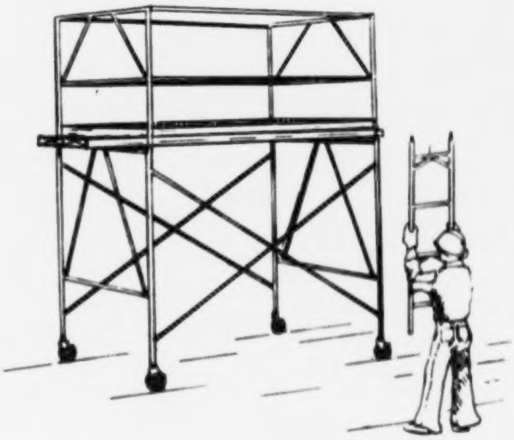
13. Lift one end of scaffold and insert casters; lock casters. ___ ___

14. Lift opposite end of scaffold and insert casters; lock casters. ___ ___

Yes No

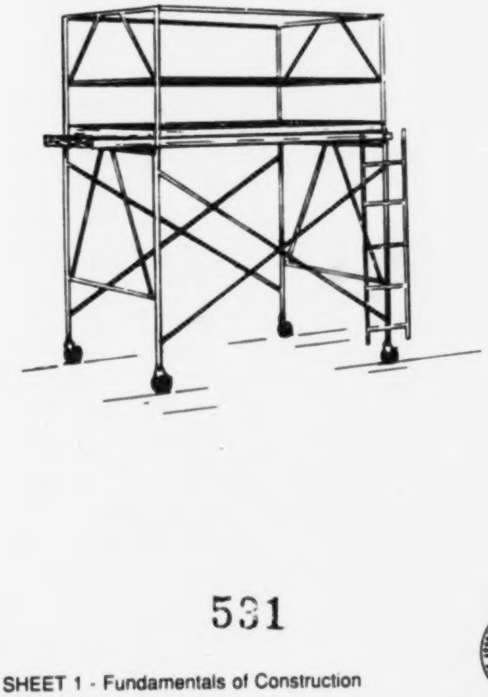
15. Attach ladder section. ___ ___

FIGURE 15



16. Inspect completed scaffold. ___ ___

FIGURE 16



	Yes	No
17. This concludes this job sheet. Ask your instructor to evaluate your assembled scaffold.	___	___
18. Disassemble and put away all materials.	___	___

(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Observed safety procedures	4	3	2	1
Scaffold level and plumb	4	3	2	1

EVALUATOR'S COMMENTS

____

____

____

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** Can perform job with no additional training

3 **Moderately Skilled** Has performed job during training program; limited additional training may be required

2 **Limited Skill** Has performed job during training program; additional training is required to develop skill

1 **Unskilled** Is familiar with process, but is unable to perform job

WRITTEN TEST

LADDERS AND SCAFFOLDS

D 2

Name ______________________________ Score __________

OBJECTIVE 1

Given a list of terms associated with ladders and scaffolds, match them to their correct definitions. Write the letter that corresponds to the most correct answer.

_____ 1. What is the term used to describe a safety device on the bottom of ladders to prevent the ladder heel from sliding?

a. Safety shoe
b. Skid pad
c. Slide rail
d. Toeboard

_____ 2. A continuous timber placed on the ground to support scaffolds is called a/an:

a. toeboard
b. footer
c. cleat
d. mudsill

_____ 3. Which of the following devices are attached to the base of scaffolds to give them a broader base of support?

a. Putlogs
b. Cleats
c. Outriggers
d. Broad boards

_____ 4. A rope used to guide or steady a load being hoisted is called a/an:

a. guideline
b. bearer
c. tagline
d. safety rope

May be photocopied for student use.

_____ 5. What is the term used to describe a device attached to the top of scaffolds used for attachment of shoring?

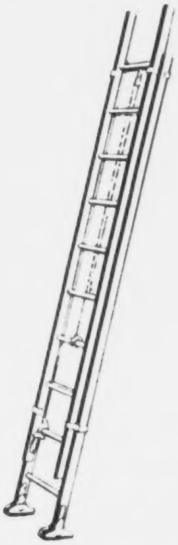
a. Shore pins
b. "U" or "j" heads
c. Catwalks
d. Casters

_____ 6. The maximum height a worker should ascend a ladder is called the:

a. top level
b. safety rung
c. bearer level
d. standing or working level

OBJECTIVE 2 **Given drawings, match ladders and scaffold types to their identities.**

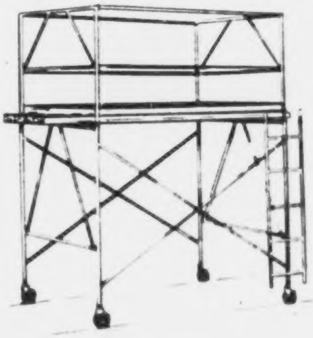
_____ 1. The type of ladder shown in the figure below is called a/an ______________________ ladder.



a. extension
b. step
c. single, straight
d. double, locking

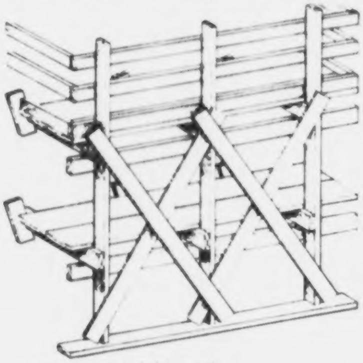
May be photocopied for student use

_____ 2. The type of scaffold shown in the figure below is called a ____________________ scaffold.



a. double pole
b. swinging
c. cylinder
d. prefabricated

_____ 3. The scaffold type illustrated below is called a



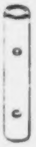
a. double pole
b. single pole
c. scaffold jack
d. prefabricated

May be photocopied for student use.

OBJECTIVE 3 **Given pictures, choose the proper name for scaffold parts.**

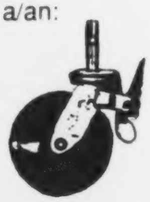
_____ 1. What is the name of the scaffold part illustrated below?

a. Coupling pin
b. Framing member
c. Base plate
d. Crossbrace



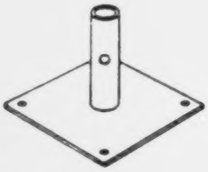
_____ 2. The illustration shown is known as a/an:

a. base plate
b. rolling bracket
c. caster
d. wedge roller



_____ 3. What is the term that best describes the scaffold part shown below?

a. Mudsill
b. Base plate
c. Foot member
d. Caster



OBJECTIVE 4 **Choose, from a group of alternatives, the proper safety rules in the use of ladders and scaffolds.**

_____ 1. All scaffolds must be equipped with:

a. top rail
b. midrail
c. toeboard
d. all the above

_____ 2. Before ascending a rolling scaffold be sure to *always*:

a. remove the toeboard
b. install outriggers
c. lock the casters
d. all the above

May be photocopied for student use

_____ 3. Before using a ladder, you should consult _______________ to verify the highest working or standing level.

   a. manufacturer's specifications
   b. co-worker
   c. local building codes
   d. consumer's guide

_____ 4. Metal ladders should never be used when:

   a. working above 16 feet
   b. working weights are above 180 pounds
   c. working near electrical conductors
   d. using any kind of hand tool

_____ 5. Which of the following safety rules must be followed in using stepladders?

   a. Never climb a ladder alone.
   b. Fully spread and lock legs.
   c. Climb and work from the top platform.
   d. Remove safety shoes when working above 16 feet.

_____ 6. An extension ladder should extend a minimum of _______________ feet above the top support.

   a. 1
   b. 2
   c. 3
   d. 4

_____ 7. Scaffolds must be checked to ensure they are __________ ______________________ before use.

   a. level and plumb
   b. equipped with a 12" high top rail
   c. tied off when above four feet high
   d. equipped with safety shoes

May be photocopied for student use.

_____ 8. Workers should not ascend scaffolds:

a. during periods of high wind
b. when covered with ice or snow
c. during storms
d. all of the above

_____ 9. When using a ladder, never carry _______________ up a ladder.

a. bricks
b. lumber
c. siding
d. any load, including all the above

NOTE: Objectives 10-15 are evaluated on job sheets/assignment sheets in this unit. If you have not completed these components, see your instructor.

May be photocopied for student use.

WRITTEN TEST ANSWERS

LADDERS AND SCAFFOLDS

D 2

OBJECTIVE 1

1. a
2. d
3. c
4. c
5. b
6. d

OBJECTIVE 2

1. a
2. d
3. b

OBJECTIVE 3

1. a
2. c
3. b

OBJECTIVE 4

1. d
2. c
3. a
4. c
5. b
6. c
7. a
8. d
9. d

OBJECTIVE 5

Objective 5 is evaluated through the completion of a job sheet.

OBJECTIVE SHEET

RIGGING AND MATERIAL HANDLING

D 3

INTRODUCTION

The movement of materials can be more effective and safe when proper rigging techniques are used. The information in this unit will help you to learn the basics of rigging and material handling.

UNIT OBJECTIVES

After completion of this unit, the student will be able to calculate safe working loads, spreading angles, and sling stress. You should also be able to safely rig loads using good rigging practices. The student will show this knowledge by completing assignment sheets, job sheets, and written test with a minimum score of 85 percent accuracy.

SPECIFIC OBJECTIVES

After completing this unit, the student will be able to:

1. Given a list of terms associated with rigging and material handling, match them to their correct definitions.
2. Given drawings, match load lifting accessories with their identities.
3. Given alternatives, identify the various methods to use rope safely in rigging. (Assignment Sheet 1)
4. Choose the proper safety guidelines in rigging and material handling. (Assignment Sheet 2)
5. Given pictures, differentiate between hand signals used in rigging and material handling. (Assignment Sheet 3)
6. Prepare rope and wire rope for rigging. (Job Sheet 1)
7. Rig and handle loads using proper hand signals. (Job Sheet 2)

votech

PREPARATION

- Review unit and plan presentation.
- Obtain materials to supplement unit.

EXAMPLES:
OSHA standards for the construction industry
Samples of rigging equipment and accessories
Sections of various sizes or rope and cables
Various types of cable fittings

DELIVERY

Objective 1: Given a list of terms associated with rigging and material handling, match them to their correct definitions.

- Discuss terms and definitions associated with rigging and material handling.
- Show students examples to illustrate appropriate terms.
- Explain that commonality of term meaning is required for communication with workers within the trade and with workers from related trades employed on the job site.

Objective 2: Given drawings, match load lifting accessories with their identities.

- Discuss load lifting accessories and the various types of hitches used to attach materials and equipment to the hoist.
- Show students samples of the various types of accessories and hitches.
- Demonstrate how to attach the various hitches to different types of loads.

APPLICATION

Objective 3: Given alternatives, identify the various methods to use rope safely in rigging. (Assignment Sheet 1)

- Manila rope
  - Discuss elements of knots, bends and hitches, and the various types of knots that may be used in rigging.
  - Discuss uses of the various types of knots. Explain that a good knot should be easy to tie; it should hold without slipping and it should be easy to untie.
  - Discuss precautions to observe when caring for ropes.
  - Show students examples of old ropes that have not been properly cared for.
  - Demonstrate how ropes should be coiled and stored so that air may circulate around the rope.
  - Have students demonstrate how to coil and uncoil rope.
  - Allow students to wash and properly dry rope; also allow them to treat rope with a thin lubricating oil or warm petrolatum.
  - Discuss the importance of properly caring for ropes.
  - Use Transparency 2 to demonstrate how to calculate safe working load of different types and sizes of rope using a formula and proper mathematical constant.
  - Have students demonstrate how to calculate safe working load of various types and sizes of rope using a formula by completing Assignment Sheet 1.
- Wire rope
  - Discuss how to calculate the safe working load of different sizes of wire rope.

  - Demonstrate how to calculate the safe working load of various sizes of wire rope.
  - Have students demonstrate how to calculate safe working load of various sizes of wire rope, then have them complete Assignment Sheet 1.

Objective 4: Choose the proper safety guidelines in rigging and material handling. (Assignment Sheet 2)

- Discuss safety tips related to rigging and material handling.
- Show students copies of OSHA regulations pertaining to rigging and material handling.
- Take a field trip to a job-site where rigging and material handling procedures are being used. Have students discuss proper rigging practices they observe and any violations that they see.
- Use Transparency 1 to discuss the importance of spreading sling angles and how reducing the angle reduces the lifting capacity.
- Draw an illustration showing vertical and various degrees of angles and point out how the lifting capacity is reduced as the angle is reduced.
- Discuss how to calculate sling stress using a formula.
- Demonstrate how to calculate sling stress using different load weights, number, and length of slings and different height of loads.
- Have students demonstrate how to calculate sling stress using a formula.
- Have students complete Assignment Sheet 2.

Objective 5: Given pictures, differentiate between hand signals used in rigging and material handling. (Assignment Sheet 3)

- Discuss hand signals used in rigging operations.

- Demonstrate different hand signals that are illustrated in the information.

- Have students practice recognizing hand signals by completing Assignment Sheet 3.

- Allow the students to pair off and practice giving and recognizing the hand signals to each other in the shop or in the field.

Objective 6: Prepare rope and wire rope for rigging. (Job Sheet 1)

- Discuss types of cable fittings.

- Show students samples of various types of cable fittings.

- Demonstrate procedures in Job Sheet 1.

- Have students identify and discuss how the various fittings are used.

- Have students demonstrate procedures in Job Sheet 1.

Objective 7: Rig and handle loads using proper hand signals. (Job Sheet 2)

- Use Job Sheet 2 to give students an opportunity to develop skills for rigging and handling different types of loads and using proper hand signals.

EVALUATION

Pretest

- Give written test as pretest.

- Determine individual study requirements from pretest results.

- Counsel students individually on pretest results and study requirements.

- Modify materials in unit or create supplementary materials for individual students as required.

Skill Test

- Evaluate students on assignment sheet activities.

- Evaluate students on job sheet activities.

- Complete appropriate section of competency profiles.

- Reteach and reevaluate if necessary.

- Modify materials in unit or create supplementary materials for individual students as required.

Written Test

- Explain to students that they will be asked to demonstrate on the written test actions listed in the specific objectives.

- Evaluate students on assignment sheet activities.

  NOTE: The written test may be given in sections if desired.

- Give the written test.

- Reteach and retest if necessary.

- Review individual and group performance in order to evaluate teaching methods. Adjust scope, sequence, or instructional approaches for additional lessons as required.

SUGGESTED RESOURCES

Print Media

- *Handbook for Riggers*, P.O. Box 2999, Calgary, Alberta, Canada (Latest edition)

  NOTE: Address requests for handbook to "Handbook for Riggers," P.O. Box 2999, Calgary, Alberta, Canada T2P 2M7.

- *Standards for the Construction Industry*. U.S. Department of Labor, Occupational Safety and Health Administration Publications Distribution, Room S-4203, Washington, D.C. 20210.

- *Rigging*. Technical Manual No. 5-725, Headquarters, Department of the Army, Washington, D.C.

UNIT REFERENCES

- Hendrix, Laborn J. "Bud." *Heavy Equipment Operator Instructional Materials—Basic Core*. Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and the Associated General Contractors of America: Stillwater, OK, 1981.

- Willey, Al. *Fundamentals of Carpentry*. Oklahoma Department of Vocational and Technical Education/Curriculum and Instructional Materials Center and the Associated General Contractors of America: Stillwater, OK, 1993.

INFORMATION SHEET

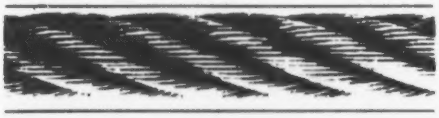
RIGGING AND MATERIAL HANDLING

D 3

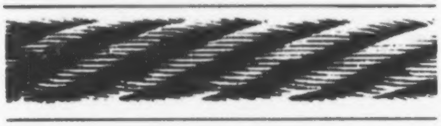
OBJECTIVE 1

Given a list of terms associated with rigging and material handling, match them to their correct definitions.

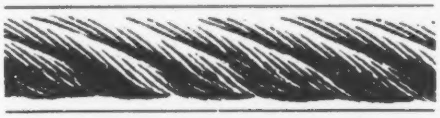
- **bridle** — lines attached to lifting hooks that distribute the load
- **center of gravity** — that point in a body about which all the weights of the various parts balance
- **critical angle** — sling angle that exists when the tension in the sling leg equals the weight of the load
- **dog** — a hand signal or term used to indicate to someone to secure everything
- **eye** — metal loop which engages a hook
- **hitch** — to attach a rope to a post, pole, ring, hook, or other object
- **lay** — direction, length, or angle of twist of the strands in a rope or cable



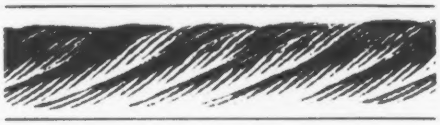
Right, regular-lay rope



Left, regular-lay rope



Right, Lang-lay wire rope



Left, Lang-lay wire rope

- **preforming** — preliminary shaping of wires so that they will lie in place
- **psi** — pounds per square inch
- **rigging** — setting up block and tackle of a winch, stacking and hoisting material and equipment and/or replacing cables on equipment
- **shackle** — U-shaped metal device used to secure lines together for lifting loads
- **sheave** — grooved wheel or pulley
- **snatch block** — pulley in a case which can be easily fastened to lines or objects by means of a hook, ring, or shackle
- **splice** — to join two sections of rope or cable together for form a continuous length
- **spreaders** — devices used to prevent crushing of load and to lift extra long and heavy loads
- **tackle** — assembly of blocks and lines used to gain a mechanical advantage in lifting
- **tagline** — rope used to guide and/or steady load being hoisted
- **thimble** — grooved metal ring inserted in loop of rope to prevent wear

OBJECTIVE 2 **Given drawings, match load lifting accessories with their identities.**

1. Choker (single slings)
2. Grommet sling
3. Web sling

FIGURE 1

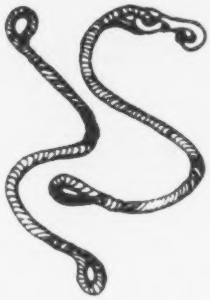


FIGURE 2

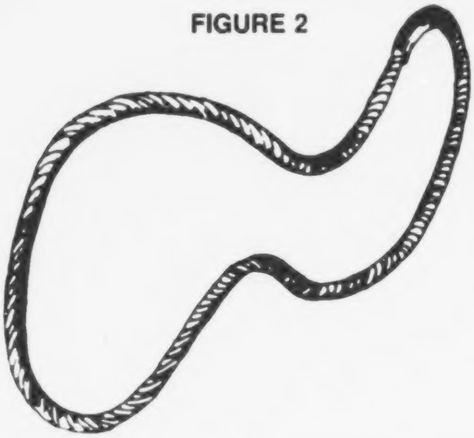
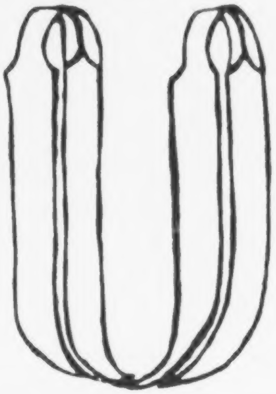


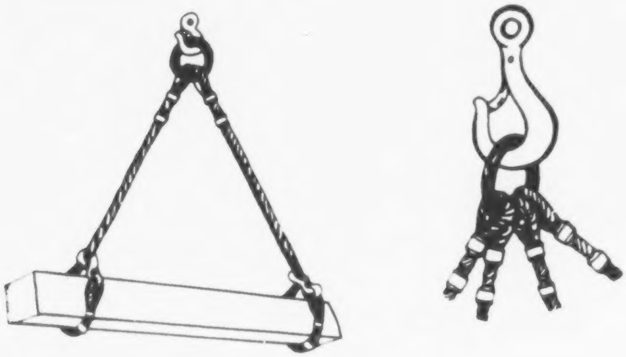
FIGURE 3



NOTE: Inspect chokers and slings carefully before each use.

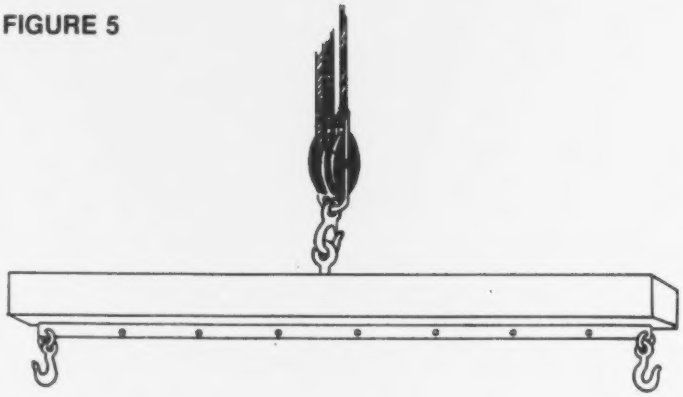
4. Bridles

FIGURE 4



5. Spreader bars

FIGURE 5



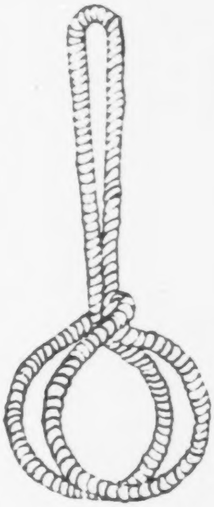
6. Hitches

⚠ **CAUTION:** The placement of hitches on the load is very critical. Caution must be taken of be sure hitches are made secure and safe.

---

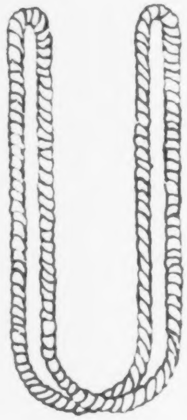
1. Choker hitch sling

FIGURE 6



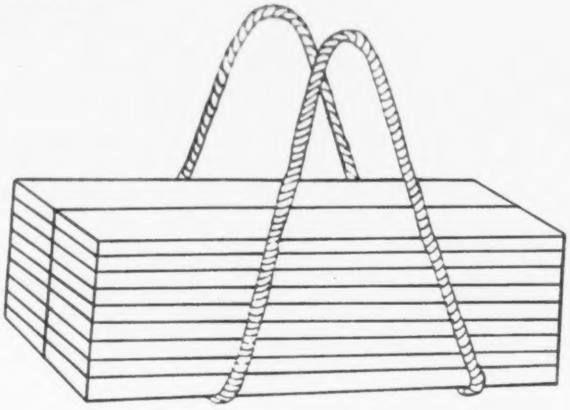
2. Basket hitch sling

FIGURE 7



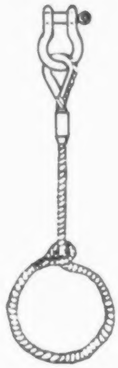
3. Inverted basket hitch sling

FIGURE 8



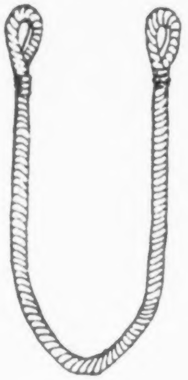
4. Choker hitch choker

FIGURE 9



5. Basket hitch choker

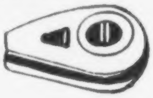
FIGURE 10



Types of wire rope or cable fittings

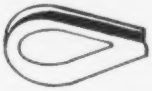
1. Standard solid thimble

FIGURE 11



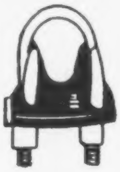
2. Standard hawser thimble

FIGURE 12



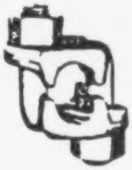
3. U-bolt wire rope clip

FIGURE 13



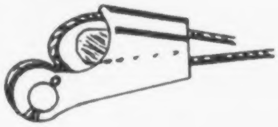
4. Fist grip wire rope clip

FIGURE 14



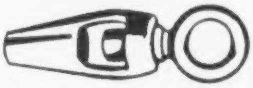
5. Open wedge socket

FIGURE 15



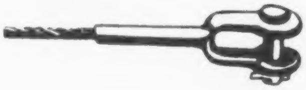
6. Swivel eye and socket

FIGURE 16



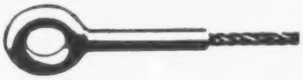
7. Swaged clevis fitting

FIGURE 17



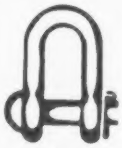
8. Swaged round eye fitting

FIGURE 18



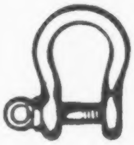
9. Standard shackle

FIGURE 19



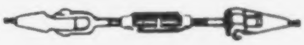
10. Screw pin shackle

FIGURE 20



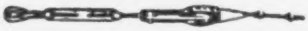
11. Turnbuckle with socketed rope

FIGURE 21



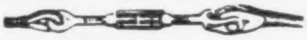
12. Turnbuckle with clipped rope

FIGURE 22



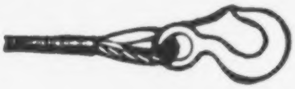
13. Turnbuckle with spliced rope

FIGURE 23



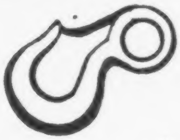
14. Drop forged steel hook with thimble

FIGURE 24



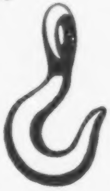
15. Drop forged steel hook with eye

FIGURE 25



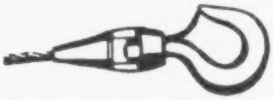
16. Reversed eye hook

FIGURE 26



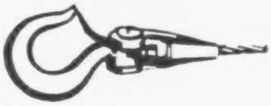
17. Drop forged steel swivel hook and socket

FIGURE 27



18. Logging swivel hook and socket with double swivel

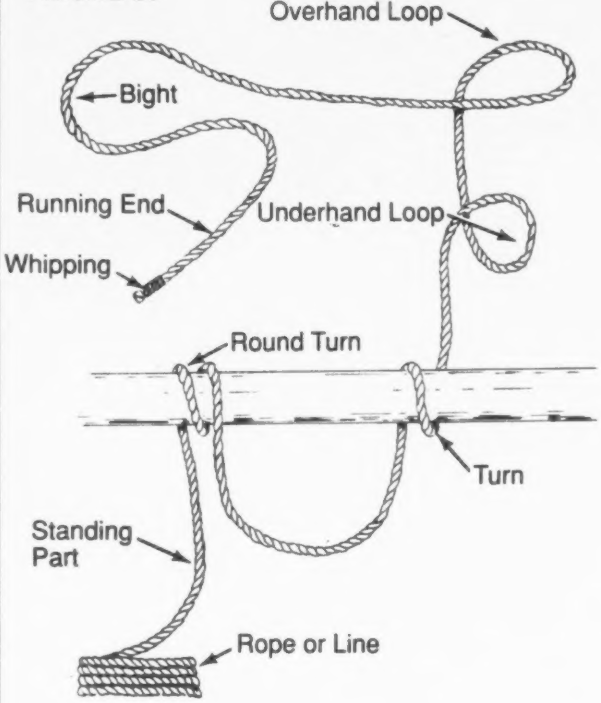
FIGURE 28



OBJECTIVE 3 **Given alternatives, identify the various methods to safely use rope in rigging.** (Assignment Sheet 1)

1. Rope elements

FIGURE 29


Overhand Loop
Bight
Running End
Underhand Loop
Whipping
Round Turn
Turn
Standing Part
Rope or Line

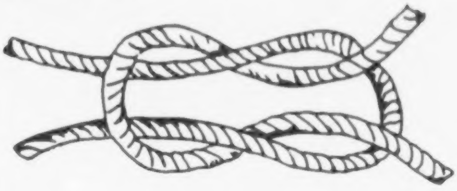
2. Types of knots

NOTE: The efficiency of manila rope decreases considerably when using knots and splices.

EXAMPLE:
Straight rope = 100% strength
Eye splice = 85% strength
Clove hitch = 75% strength
Bowline = 53% strength
Square knot = 43% strength
Sheepshank = 35% strength

- **square knot** — ties two lines of equal size together so that they will not slip

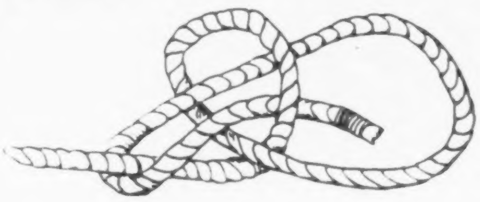
FIGURE 30



- **bowline** — forms a single loop that will not tighten or slip under strain

  NOTE: This is one of the best knots to use to lower people or materials.

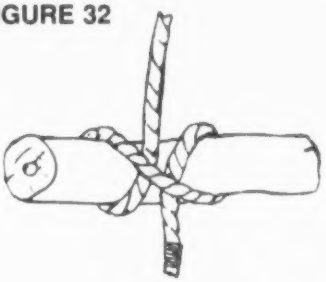
FIGURE 31



- **clove hitch** — fastens a line to timber or pipe

  NOTE: This is probably one of the most widely used knots.

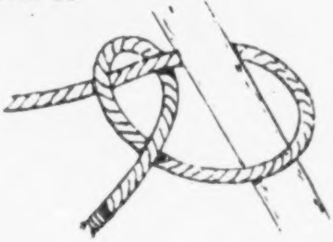
FIGURE 32



- **half hitch** — ties line to timber or to a larger line

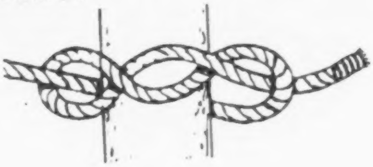
  NOTE: This is a quick and easy knot to use when tying down a tarp or plastic covering.

FIGURE 33



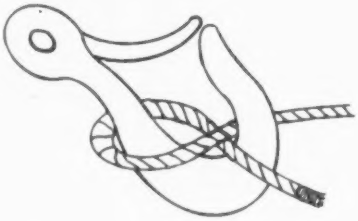
- **timber hitch** — holds timber securely when moving heavy timber or poles because of the pressure of one coil over other; the more tension applied, the tighter the hitch

FIGURE 34



- **blackwall hitch** — fastens a line to a hook; generally used temporarily

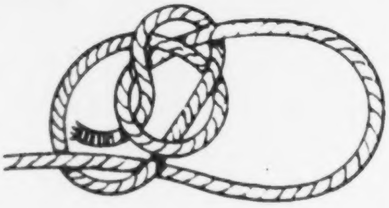
FIGURE 35



557

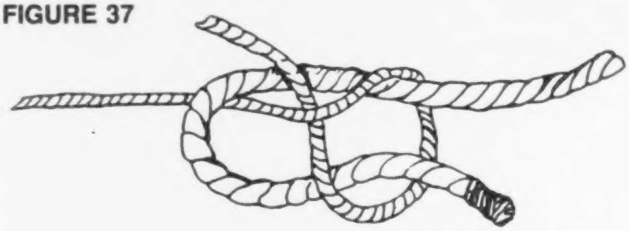
- **running bowline** — forms a strong running loop which is convenient for running an eye; can also provide a choker-type sling at the end of a line

FIGURE 36



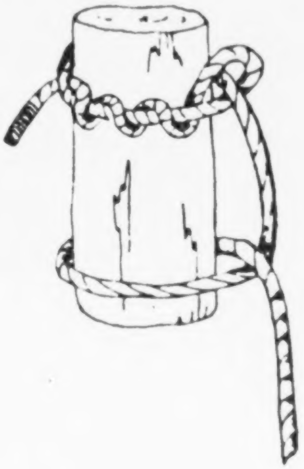
- **sheet bend** — ties two lines of unequal size together; also used to tie a line to an eye

FIGURE 37



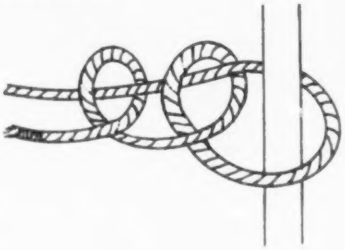
- **timber hitch with half hitch** — holds heavy timbers or poles for lifting or dragging

FIGURE 38



- **two half hitches** — secure running end of line to standing part

FIGURE 39



- **Precautions when caring for rope.**
  - When taking rope from a coil, always remove it from the center in a counter-clockwise direction.

- When rope is not in use, it should be re-coiled in a clockwise direction.

- When rope is attached to a hook, ring, or pulley block, a thimble should be placed in the loop or eye to reduce wear and to decrease stress.

- Protect rope from moisture and weather as much as possible. Dry before storing.

- Do not disturb a frozen rope until completely thawed.

- Keep rope away from acids, other chemicals, and heat.

- Do not drag rope over ground or sharp edges.

- If possible, do not make abrupt bends in rope.

- Store rope so that air can circulate around it.

  NOTE: Hang rope in loose coil or place on wood grating above the floor.

- If manila rope becomes stiff and hard because of being wet, treat with a thin lubricating oil or warm petrolatum (a jelly-like petroleum-based dressing).

  NOTE: This can be accomplished by applying the lubricant with a paint brush.

OBJECTIVE 4

Choose the proper safety guidelines in rigging and material handling. (Assignment Sheet 2)

1. General safety rules

   - Use personal protective devices such as goggles, gloves, safety shoes, and hard hats.

   - Use taglines to guide and/or steady load.

- Do not walk under load.
- Be sure load is balanced properly.
- Do not overload equipment.
- Use corner saddles, padding, or wood blocking to protect slings from sharp bends and sharp edges.
- Avoid continuous maximum capacity loading.
- Be sure outriggers and/or stabilizers are in use and are on solid footing.
- Lubricate slings to prevent rust.
- Be sure all hooks have safety snaps.
- Check wire rope for damage.
- Be extra cautious around power lines.

⚠ **CAUTION:** There must be a minimum of ten feet between equipment and power lines. Check local requirements.

---

2. Calculate the safe working load (SWL) of different types and sizes of ropes using a formula.

NOTE: Each formula uses its own mathematical constant, a number assumed to have one value throughout the particular formula.

- **Manila rope**
  - — Change diameter of rope to eighths.

— Square numerator and multiply by 20 (mathematical constant).

EXAMPLE: ½″ manila rope = ⁴⁄₈″ diameter
SWL = 4 × 4 × 20 = 320 lbs.

- **Nylon rope and polyester rope**

— Change diameter or rope to eighths.

— Square numerator and multiply by 60 (mathematical constant).

EXAMPLE: ⅝″ nylon or polyester rope = ⅝″ diameter

SWL = 5 × 5 × 60 = 1500 lbs.

- **Polypropylene rope**

— Change diameter of rope to eighths.

— Square numerator and multiply by 40 (mathematical constant).

EXAMPLE: ¾″ polypropylene rope = ⁶⁄₈″ diameter

SWL = 6 × 6 × 40 = 1440 lbs.

- **Polyethylene rope**

— Change diameter of rope to eighths.

— Square numerator and multiply by 35 (mathematical constant).

EXAMPLE: 1″ polyethylene rope = ⁸⁄₈″ diameter

SWL = 8 × 8 × 35 = 2240 lbs.

3. Spreading sling angles (See Figure 40.)

   - Changing the angle of a sling leg may increase the stress on the sling.

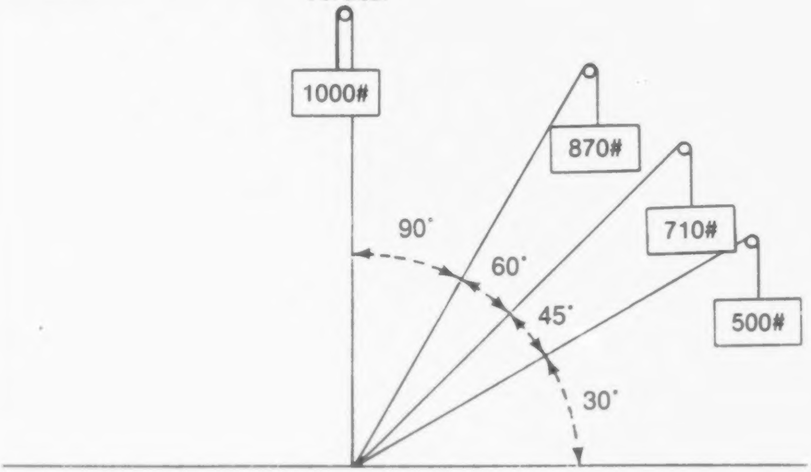
   - As the angle is reduced, lifting capacity is reduced very rapidly.

   - When a single leg of a sling is at a 60-degree angle, lifting capacity is only 87 percent of that of a vertical leg.

   - When a single leg of a sling is at a 45-degree angle, lifting capacity is only 71 percent of that of a vertical leg.

   - When a single leg of sling is at 30-degree angle, lifting capacity is only 50 percent of that of a vertical leg.

FIGURE 40



4. Calculate sling stress using formula.

$$\frac{W \times L}{H \times N} = S$$

W = Weight of load

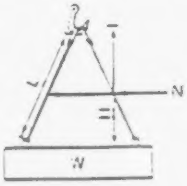
L = Length of sling

H = Height of load

N = Number of sling legs

S = Stress

EXAMPLE:



W = 10

L = 6′

H = 4′

N = 2′

$$\frac{10 \times 6}{2 \times 4} \quad \frac{60}{8} = 7\tfrac{1}{2}$$

Stress = 7½ tons each sling

5. Calculate safe working load (SWL) of different sizes of wire rope.

NOTE: Compute in tons. The number 8 is a mathematical constant. Round all answers to nearest whole number.

Formula: Rope diameter × rope diameter × 8 = SWL (tons)

EXAMPLE: ½″ diameter rope
½ × ½ × 8 = 2 tons

6. Good rigging practices.

- Turn hooks out or in the same direction.
- Use shackles on chokers where there may be cutting action.
- Pad all sharp corners and edges.
- Always make vertical lifts on eye bolts.

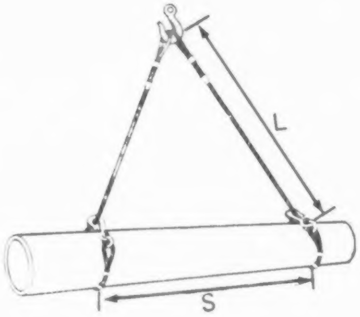
  NOTE: Lifting at an angle reduces safe load as much as 90 percent.
- Use thimble in eye splices.
- Use a shackle whenever two or more ropes are to be used over a hook.
- Use taglines to control loads.
- Secure all unused sling lines.
- Never wrap a rope around a hook.
- Do not permit bending of rope near a splice or attached fitting.
- Block all loads properly before unhooking.
- Never allow a shackle to be pulled at an angle.

  NOTE: Use washers for packing if necessary.
- Do not use screw pin shackle if the pin can roll under load and unscrew.
- Center crane over load before lifting.
- Give all hand signals clearly and correctly.
- Keep machines at least 10 feet from all electrical equipment.

- For proper sling angle, be sure that length of slings is always greater than span between the two connections.

  EXAMPLE: L (length of sling) is greater than S (span).

FIGURE 41

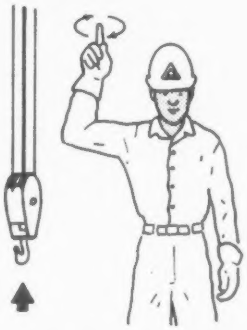


OBJECTIVE 5 **Distinguish among hand signals used in rigging operations.**

Boom and hoisting operation

1. Hoist

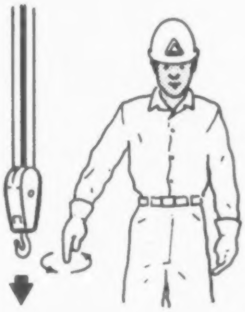
FIGURE 42



Forearm vertical, forefinger pointing up, move hand in small, horizontal circle

2. Lower load

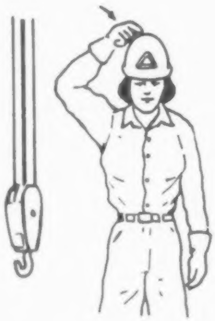
FIGURE 43



Arm extended downward, forefinger pointing down, move hand in small horizontal circles

3. Use main hoist

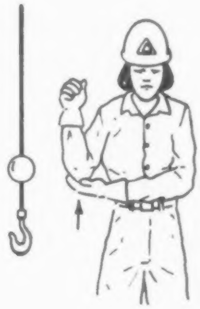
FIGURE 44



Tap fist on head then use regular signals

4. Use whipline

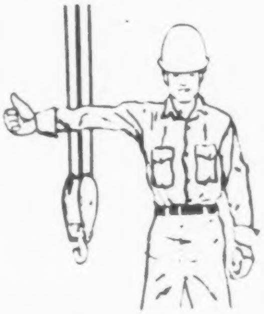
FIGURE 45



Tap elbow with one hand; then use regular signals

5. Raise boom

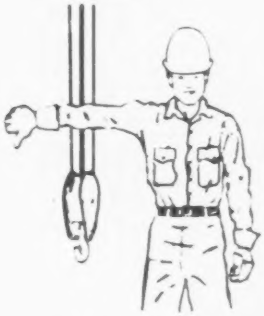
FIGURE 46



Arm extended, fingers closed, thumb pointing upward

6. Lower boom

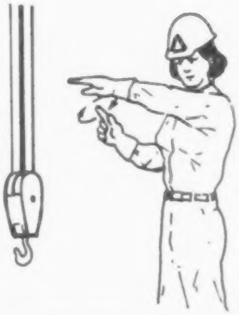
FIGURE 47



Arm extended, fingers closed, thumb pointing downward

7. Move slowly

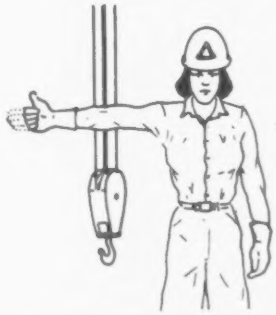
FIGURE 48



Use one hand to give any motion signal and place other hand motionless in front of hand giving the motion signal (hoist slowly shown as example).

8. Raise the boom and lower the load

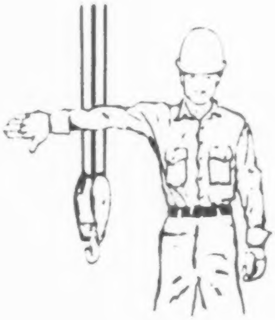
FIGURE 49



Arm extended, thumb pointing up, flex fingers in and out as long as load movement is desired.

9. Lower the boom and raise the load

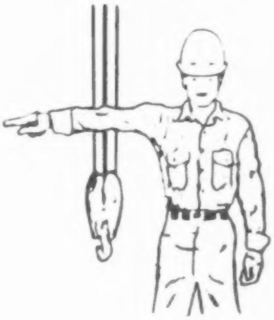
FIGURE 50



Arm extended, thumb pointing down, flex fingers in and out as long as load movement is desired.

10. Swing

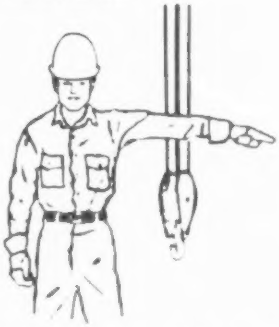
FIGURE 51



Arm extended, point with finger in direction of swing of boom,

11. Stop

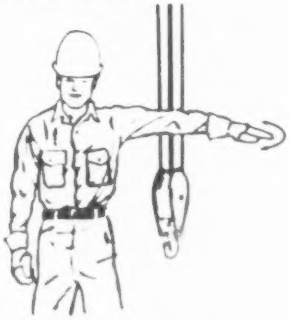
FIGURE 52



Arm extended, palm down, hold position rigidly.

12. Emergency stop

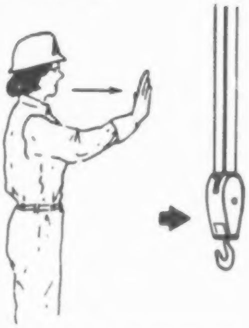
FIGURE 53



Arm extended, palm down, move hand rapidly right and left.

13. Travel

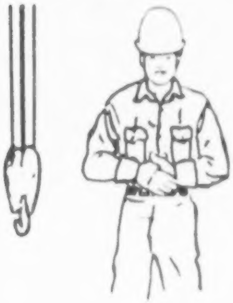
FIGURE 54



Arm extended forward, hand open and slightly raised, make pushing motion in direction of travel.

14. Dog everything

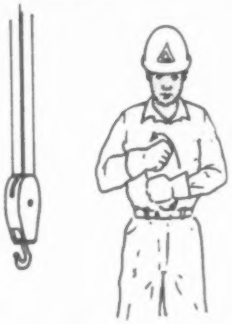
FIGURE 55



Clasp hands in front of body.

15. Travel (both tracks)

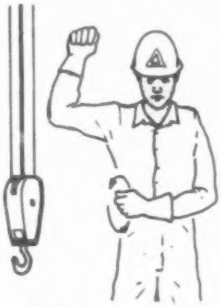
FIGURE 56



Use both fists in front of body, making a circular motion about each other indicating direction of travel: forward or backward (crawler cranes only).

16. Travel (one track)

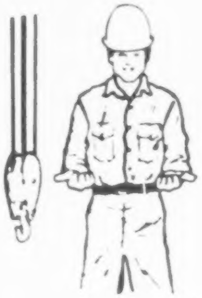
FIGURE 57



Lock the track on side indicated by raised fist, travel opposite track in direction indicated by circular motion of other fist, rotated vertically in front of body (for crawler cranes only).

17. Extend boom on hydraulic crane

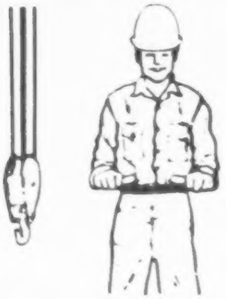
FIGURE 58



Both fists in front of body with thumbs pointing outward

18. Retract boom on hydraulic crane

FIGURE 59



Both fists in front of body with thumbs pointing toward each other

Maneuvering vehicles

1. Move

FIGURE 60

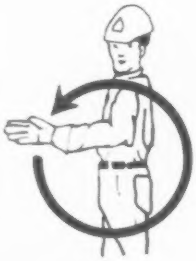
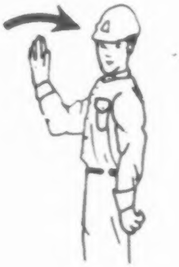


FIGURE 61



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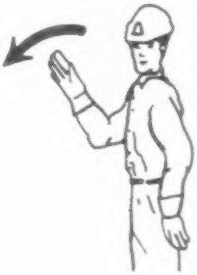
Direction of motion

FIGURE 62

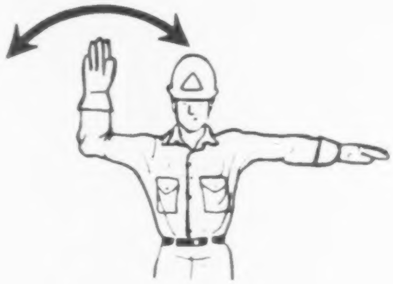


<----------------

Direction of motion

2. Turn while moving

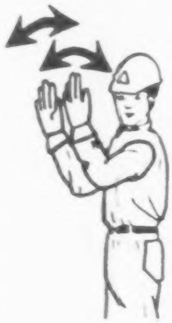
FIGURE 63



Indicate direction —
arm points in direction of turn

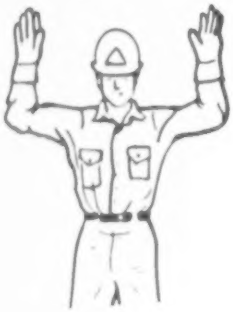
3. Straighten out

FIGURE 64



4. Stop

FIGURE 65



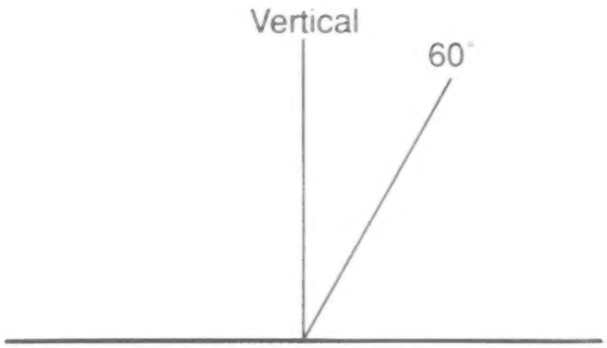
Indicate direction — arm points in direction of turn

Sling Angle

Critical Angle — Sling angle that exists when the tension in the sling leg equals the weight of the load

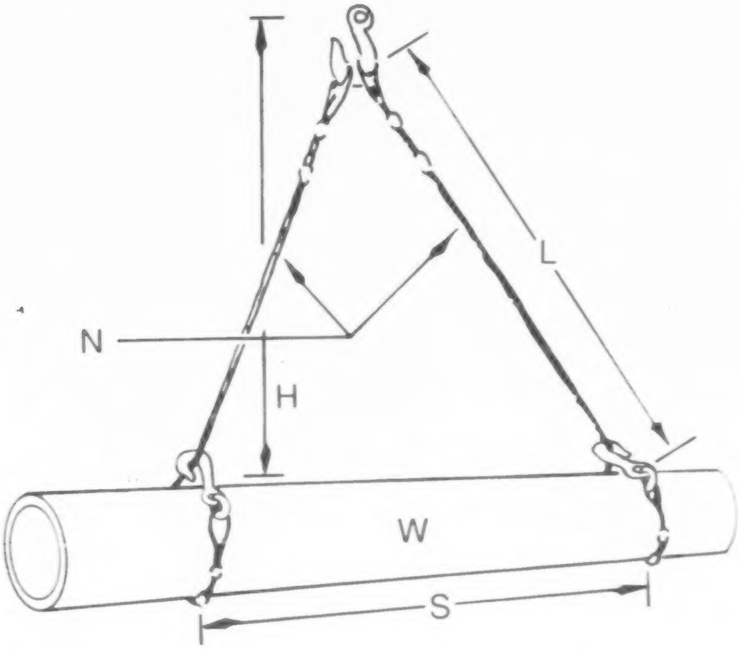
Critical Angle Formula

$$CA = \frac{60^\circ}{N}$$



N = Number of Sling Legs

Formula for Calculating Sling Stress



$$S = \frac{W \times L}{H \times N}$$

$$S = \frac{10 \times 6}{2 \times 4}$$

$$S = \frac{60}{8}$$

$S = 7\frac{1}{2}$ Tons

W = 10 Weight

L = 6′ Length

H = 4′ Height

N = 2 No. of Sling Legs

ASSIGNMENT SHEET 1

RIGGING AND MATERIAL HANDLING

D 3

Name ______________________________ Score __________

OBJECTIVE 3

Given alternatives, identify the various methods to use rope safely in rigging.

INTRODUCTION

This assignment will give you some practice in calculating the SWL of different types and sizes of rope and tying knots.

INSTRUCTIONS

Operation and Calculation Skills
- Calculate with whole numbers
- Calculate with fractions
- Convert whole numbers to fractions
- Solve formulae and equations

Math Application Skills
- Select/apply mathematical procedure

Functional Math Skills
- Solve practical problems

Job Acquisition/ Development Skills
- Master specific job task/procedure

Part 1

Calculate safe working load (SWL) of different types and sizes of ropes. Use your Information Sheet for reference.

Mathematical constants:

20 — Manila
35 — Polyethylene
40 — Polypropylene
60 — Nylon and polyester

EXAMPLE: ½" manila rope = 4/8"

SWL = 4 × 4 × 20 = 320 lbs.

1. 1" manila rope

   SWL = ______________

2. 1½" manila rope

   SWL = ______________

3. ⅜" nylon rope

   SWL = ______________

4. ⅞″ polyester rope

SWL = ________________

5. ½″ polypropylene rope

SWL = ________________

6. ⅞″ polypropylene rope

SWL = ________________

7. ¾″ polypropylene rope

SWL = ________________

8. ⅝″ manila rope

SWL = ________________

9. 1¼″ nylon rope

SWL = ________________

10. 1″ polyethylene rope

SWL = ________________

11. 1⅛″ polyester rope

SWL = ________________

12. ⅝″ polypropylene rope

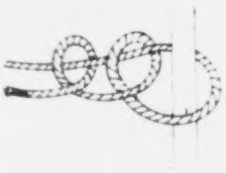
SWL = ________________

INSTRUCTIONS

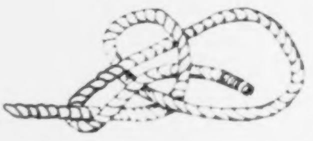
Part 2

Distinguish among types of knots by writing an "X" in the blanks under the correct illustrations.

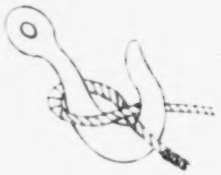
1. Bowline



a. ____________

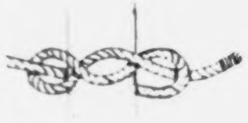


b. ____________

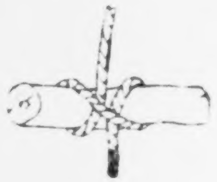


c. ____________

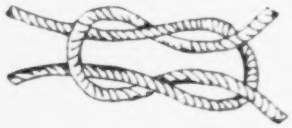
2. Square knot



a. ____________

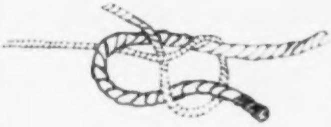


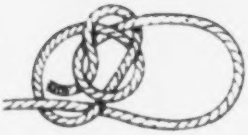
b. ____________

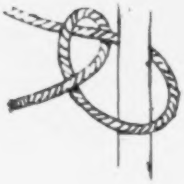


c. ____________

3. Sheet bend

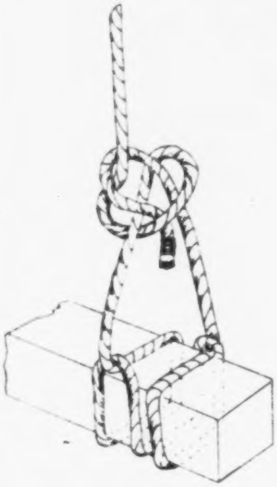


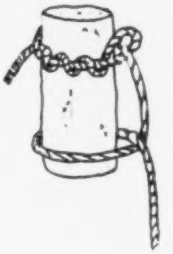


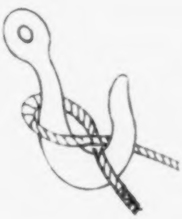


a. ____________ b. ____________ c. ____________

4. Timber hitch with half hitch







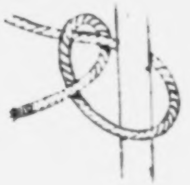
a. ____________ b. ____________ c. ____________

Write an "X" in the correct blanks.

5. _____ a. Timber hitch

_____ b. Black wall hitch

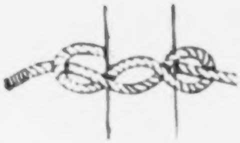
_____ c. Half hitch



6. _____ a. Clove hitch

_____ b. Timber hitch

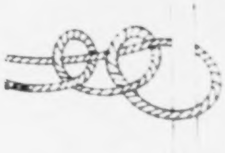
_____ c. Square knot



7. _____ a. Two half hitches

_____ b. Sheet bend

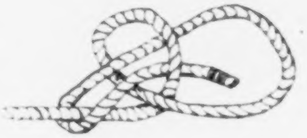
_____ c. Scaffold hitch



8. _____ a. Square knot

_____ b. Bowline

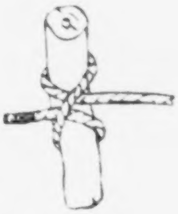
_____ c. Clove hitch



9. _____ a. Timber hitch with half hitch

_____ b. Clove hitch

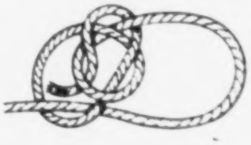
_____ c. Blackwall hitch



10. _____ a. Bowline

_____ b. Half hitch

_____ c. Running bowline



INTRODUCTION

Part 3

This assignment will give you some practice in calculating the SWL of different sizes of wire rope.

INSTRUCTIONS

Calculate safe working load (SWL) of different sizes of wire ropes. Use your Information Sheet for reference. Round all answers to the nearest whole number.

EXAMPLE: ½" diameter rope

½" × ½" × 8 = 2 tons

1. ⅝" diameter rope

   SWL = ______________

2. ⅞" diameter rope

   SWL = ______________

3. 1" diameter rope

   SWL = ______________

4. 1⅛" diameter rope

   SWL = ______________

5. 1½" diameter rope

   SWL = ______________

ASSIGNMENT SHEET 2

RIGGING AND MATERIAL HANDLING

D 3

Name ______________________________ Score __________

OBJECTIVE 4

Choose the proper safety guidelines in rigging and material handling.

INTRODUCTION

The construction worker must be proficient at accurately calculating sling stress and identifying poor rigging practices.

INSTRUCTIONS

Operation and Calculation Skills
- Calculate with whole numbers
- Calculate with fractions
- Convert whole numbers to fractions
- Solve formulae and equations

Math Application Skills
- Select/apply mathematical formula
- Apply algebra principles

Part 1

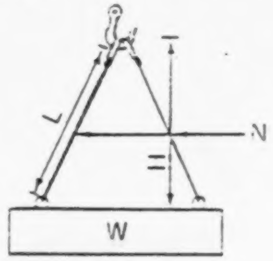
Calculate sling stress for the following illustrations.

EXAMPLE: $W = 10$ $\quad \frac{10 \times 3}{2 \times 2} = \frac{30}{4} = 7\frac{1}{2}$

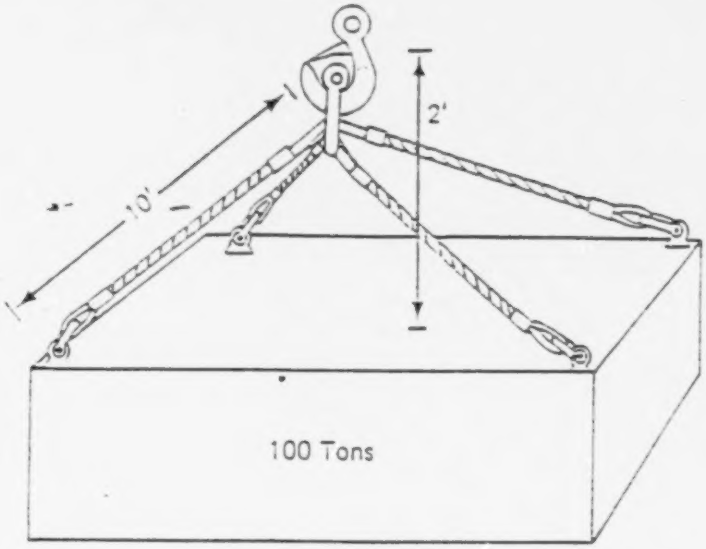
$L = 3'$

$H = 2'$ $\quad$ Stress = $7\frac{1}{2}$ tons each sling

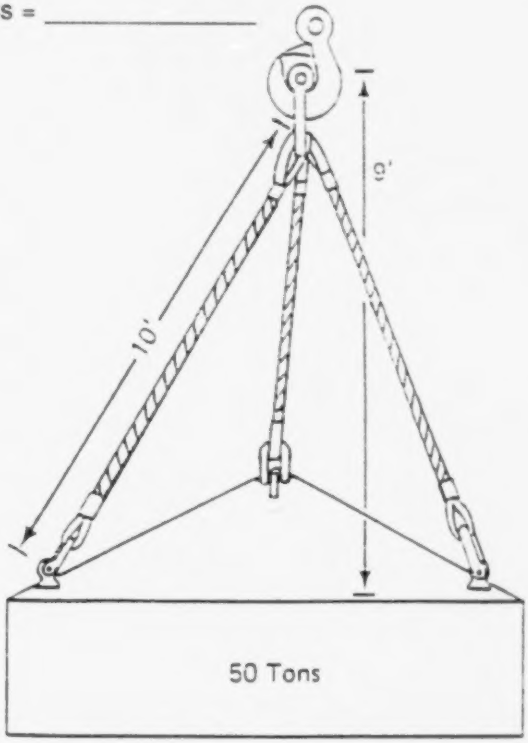
$N = 2'$



1. Sling stress = ______________


10'
2'
100 Tons

2. Sling stress = ______________

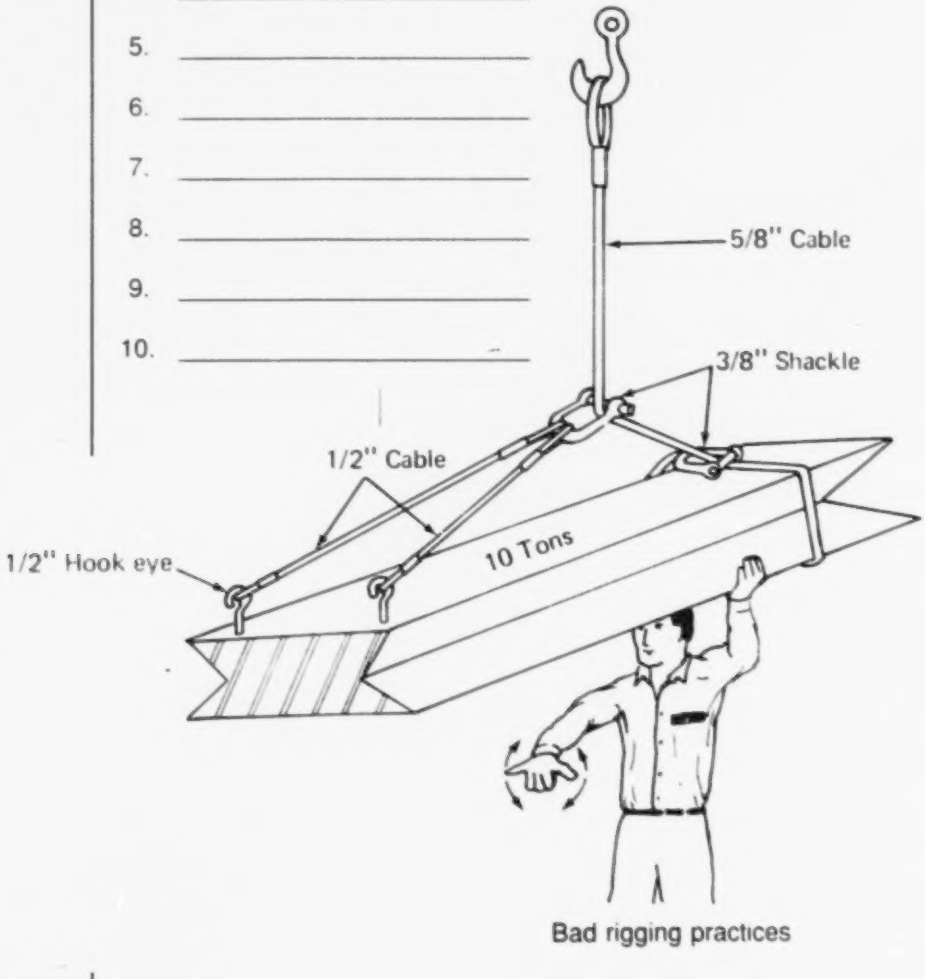


INSTRUCTIONS

Part 2

Using the illustration below, write down as many BAD rigging practices as you can find. Also list any safety tips that are not being observed in the drawing. List at least ten bad practices.

1. ______________________________
2. ______________________________
3. ______________________________
4. ______________________________
5. ______________________________
6. ______________________________
7. ______________________________
8. ______________________________
9. ______________________________
10. ______________________________


5/8" Cable
3/8" Shackle
1/2" Cable
1/2" Hook eye
10 Tons

Bad rigging practices

ASSIGNMENT SHEET 3

RIGGING AND MATERIAL HANDLING

D 3

Name ________________________________ Score __________

OBJECTIVE 5

Given pictures, differentiate between hand signals used in rigging and material handling.

INTRODUCTION

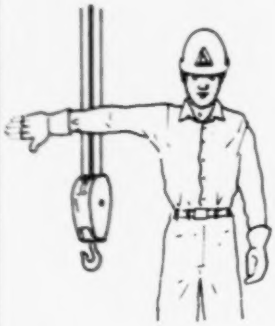
It is important for the carpenter to know how to use hand signals. Knowing hand signals and using them correctly enables the worker to assist in moving and stocking materials, to help another worker get out of a bad situation in an emergency, and possibly to avoid a serious accident.

INSTRUCTIONS

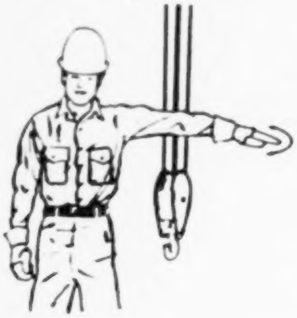
Job Acquisition/ Development Skills
- Master specific job task/procedure

Distinguish among the following hand signals by writing an "X" in the blanks below the correct illustrations.

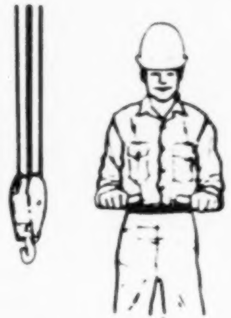
1. Emergency stop



a. __________

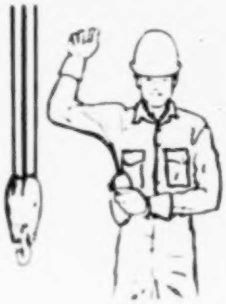


b. __________

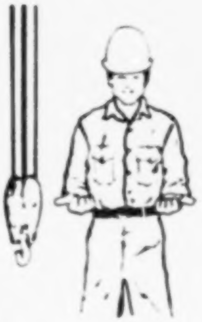


c. __________

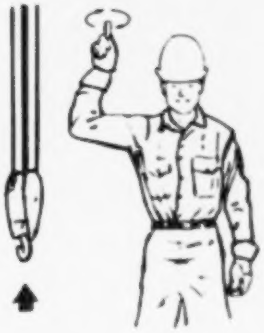
2. Hoist



a. ____________

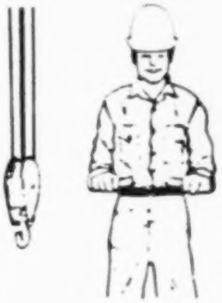


b. ____________

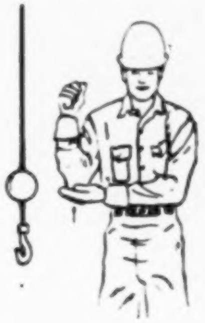


c. ____________

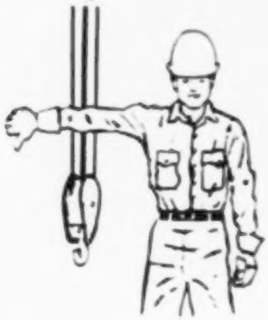
3. Retract boom



a. ____________

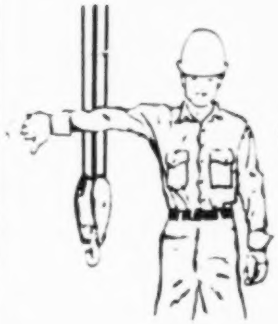


b. ____________

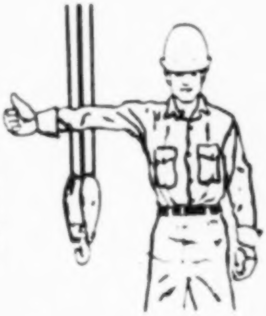


c. ____________

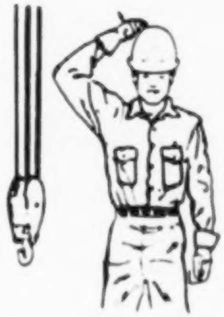
4. Lower boom and raise load



a. ____________

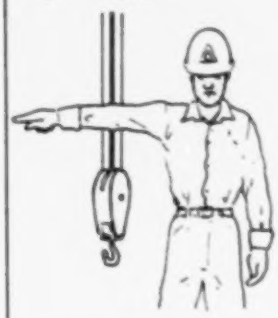


b. ____________

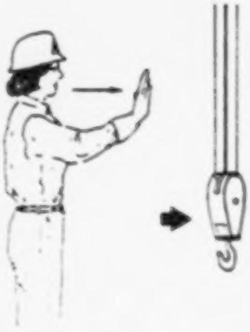


c. ____________

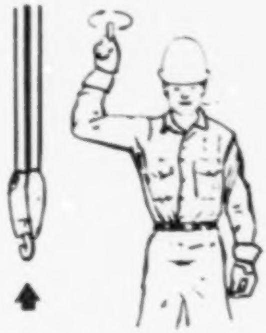
5. Travel



a. ____________

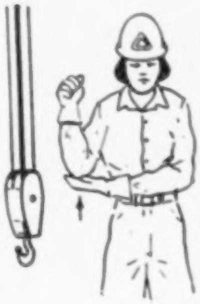


b. ____________

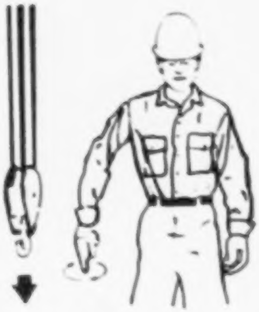


c. ____________

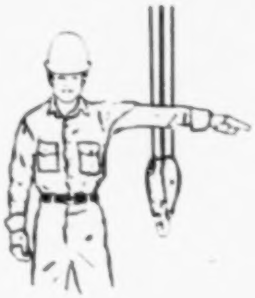
6. Stop



a. ____________

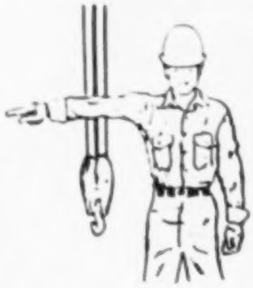


b. ____________

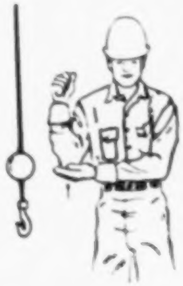


c. ____________

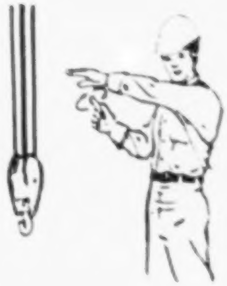
7. Move slowly



a. ____________



b. ____________



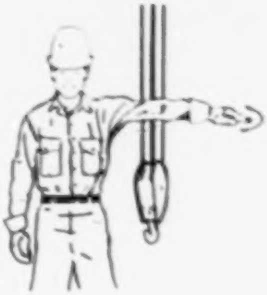
c. ____________

Write an "X" in the blank that correctly identifies the hand signal given in each illustration.

8. _____ a. Stop

_____ b. Emergency stop

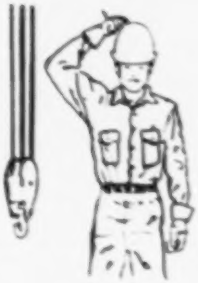
_____ c. Lower boom



9. _____ a. Travel (both tracks)

_____ b. Use whipline

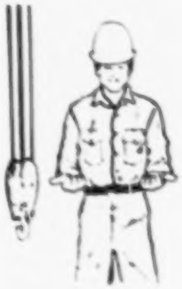
_____ c. Use main hoist



10. _____ a. Move slowly

_____ b. Extend boom

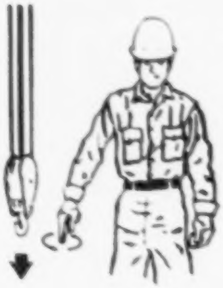
_____ c. Raise the load



11. _____ a. Lower the load

_____ b. Emergency stop

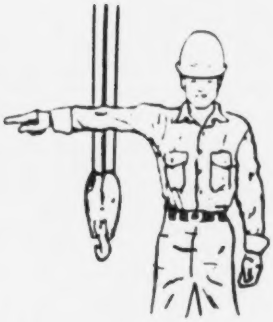
_____ c. Lower boom



12. _____ a. Swing

_____ b. Travel (one track)

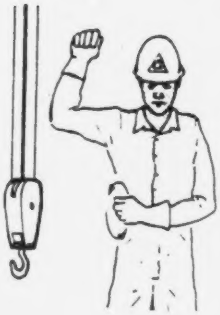
_____ c. Stop



13. _____ a. Travel (both tracks)

_____ b. Dog everything

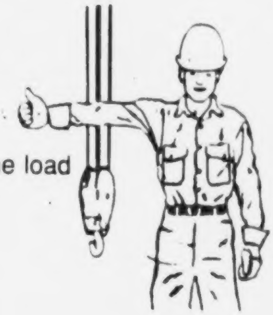
_____ c. Travel (one track)



14. _____ a. Emergency stop

_____ b. Stop

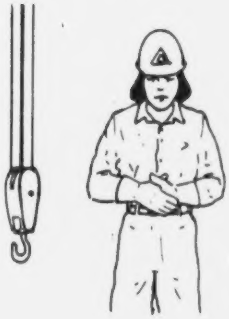
_____ c. Raise the boom and lower the load



15. _____ a. Use main hoist

_____ b. Dog everything

_____ c. Use whipline



ASSIGNMENT ANSWERS

RIGGING AND MATERIAL HANDLING

D 3

ASSIGNMENT SHEET 1

Part 1

1. 1280 lbs.
2. 2880 lbs.
3. 540 lbs.
4. 2940 lbs.
5. 640 lbs.
6. 1960 lbs.
7. 1440 lbs.
8. 500 lbs.
9. 6000 lbs.
10. 2240 lbs.
11. 4860 lbs.
12. 1000 lbs.

Part 2

1. b
2. c
3. a
4. b
5. c
6. b
7. a
8. b
9. b
10. c

Part 3

1. 3 tons
2. 6 tons
3. 8 tons
4. 10 tons
5. 18 tons

ASSIGNMENT SHEET 2

Part 1

1. 125 tons each sling
2. 18½ tons each sling

Part 2

1. Incorrect hand signals
2. Hand is on load
3. Person is under load
4. No tagline
5. Load is not balanced
6. No padding on sharp edges
7. No safety latch on hook block
8. Hook eyes too small and not in far enough
9. Sling angle too small
10. All sling cables too small
11. Shackles too small
12. Not wearing hard hat

ASSIGNMENT SHEET 3

1. b
2. c
3. a
4. a
5. b
6. c
7. c
8. b
9. c
10. b
11. a
12. a
13. c
14. c
15. b

JOB SHEET 1

RIGGING AND MATERIAL HANDLING

D 3

Name ______________________________ Score __________

OBJECTIVE 6

Prepare rope and wire rope for rigging.

TOOLS AND EQUIPMENTS

- Two pieces of equal-sized rope
- One piece of different-sized rope
- One piece timber or pole
- Length of ⅜″ wire rope
- U-bolt clips, 3 for ⅜″ wire rope
- Thimble for ⅜″ wire rope
- Wrench (to fit nuts on clips)
- Torque wrench

PROCEDURE

Functional Reading Skills
- Follow written instructions

Job Acquisition/ Development Skills
- Master specific job task/procedure
- Practice good work habits/attitudes

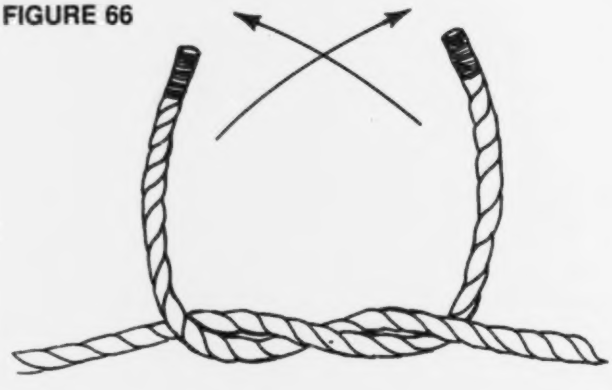
Part 1 — Prepare rope Yes No

- Square knot

NOTE: When tying a square knot, it is good to remember left-over-right and right-over-left.

1. Use two pieces of equal-sized rope. ___ ___
2. Grasp one piece of rope in each hand about eight inches from end. ___ ___
3. Cross left end over right end. ___ ___

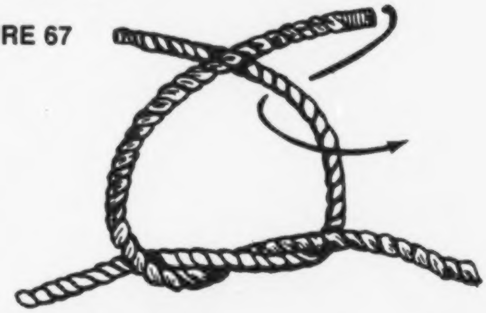
FIGURE 66



Yes No

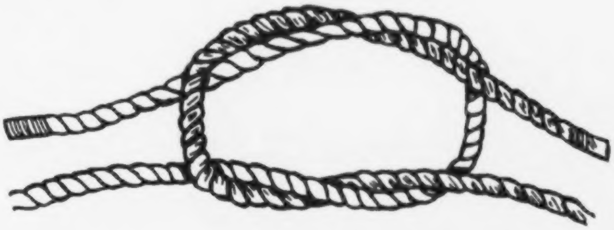
4. Cross right end over left end. ___ ___

FIGURE 67



5. Pull the knot snug. ___ ___

FIGURE 68



PROCEDURE

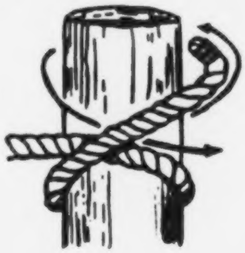
Clove hitch

1. Grasp one piece of rope and make one turn around a piece of timber. ___ ___

Yes No

2. Cross the end over the standing part. ___ ___

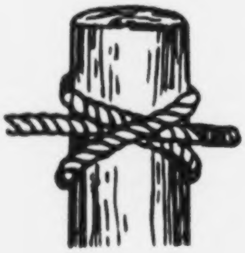
FIGURE 69



3. Take another turn around timber, and this time bring the end under the standing part. ___ ___

4. Pull the knot snug. ___ ___

FIGURE 70

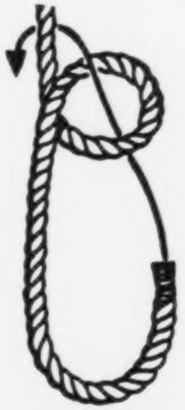


PROCEDURE Bowline

1. Form an underhand loop several inches from end of rope. ___ ___

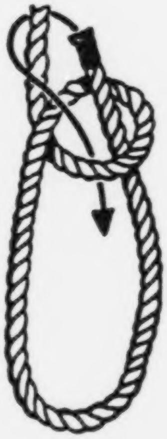
	Yes	No
2. Pull rope end up through the loop from the back, leaving desired loop size.	___	___

FIGURE 71



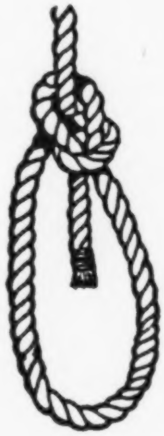
	Yes	No
3. Twist rope end around the standing part and back through the loop.	___	___

FIGURE 72



	Yes	No
4. Pull the knot snug.	___	___

FIGURE 73

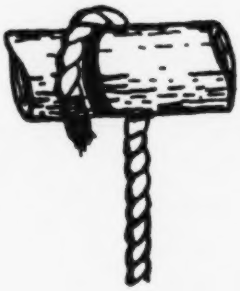


PROCEDURE

Half hitch

1. Make a turn over a piece of timber.	___	___

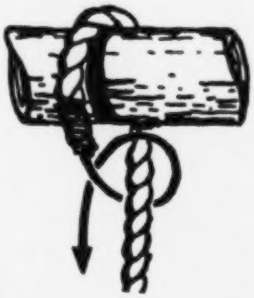
FIGURE 74



Yes No

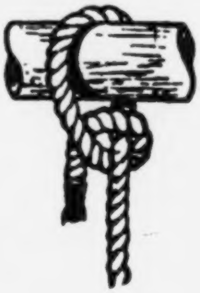
2. Make a turn around and over the standing part and back through the loop that was formed. ___ ___

FIGURE 75



3. Pull knot snug. ___ ___

FIGURE 76



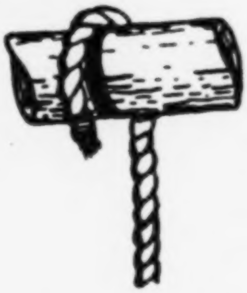
PROCEDURE

Two half hitches

Yes No

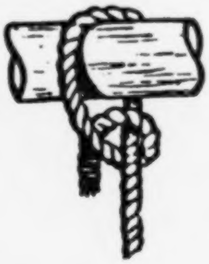
1. Make a turn over a piece of timber. ___ ___

FIGURE 77



2. Make a turn around and over the standing part and back through the loop that was formed. ___ ___

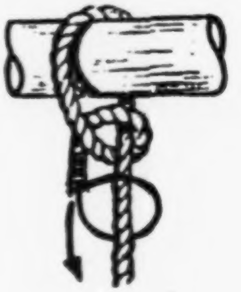
FIGURE 78



Yes No

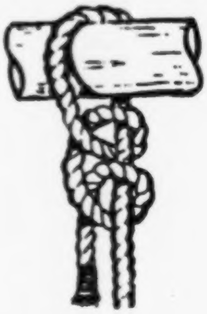
3. Make another turn around the standing part and back through the loop that was formed. ___ ___

FIGURE 79



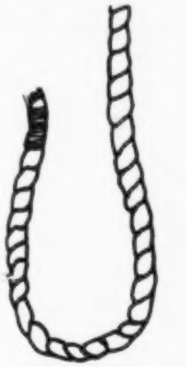
4. Pull knot snug. ___ ___

FIGURE 80



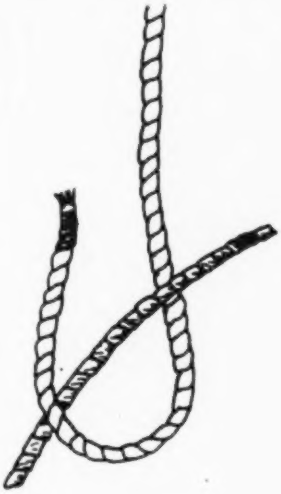
		Yes	No
PROCEDURE	Sheet bend		
	1. Form a loop on the end of one rope.	___	___

FIGURE 81



2. Lay second rope through the loop. ___ ___

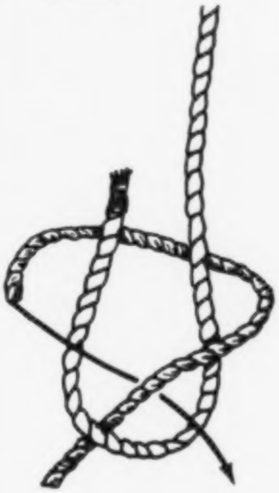
FIGURE 82



Yes No

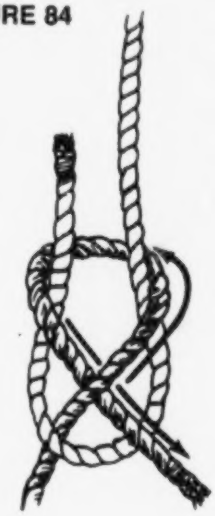
3. Twist end of second rope around standing part and running end of first rope. ___ ___

FIGURE 83



4. Continue bringing second rope around first rope; then run the end under standing part of itself and over first rope. ___ ___

FIGURE 84



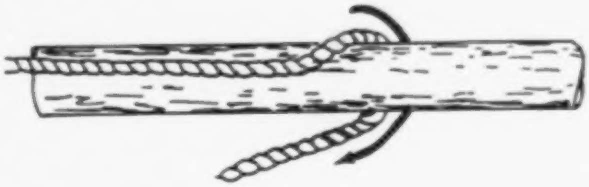
Yes No

PROCEDURE

Timber hitch with half hitch

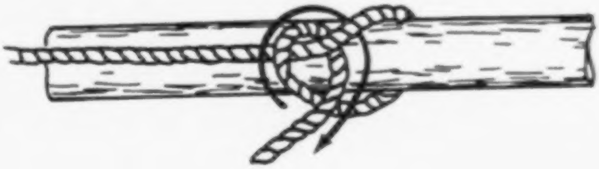
1. Lay rope lengthwise on timber; then make a turn over and around the piece of timber. ___ ___

FIGURE 85



2. Place rope over and then under itself forming loop. ___ ___

FIGURE 86



3. Wrap end back around itself two or three times. ___ ___

FIGURE 87

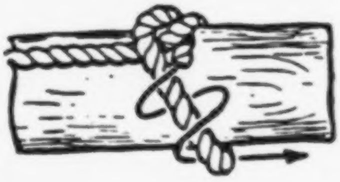
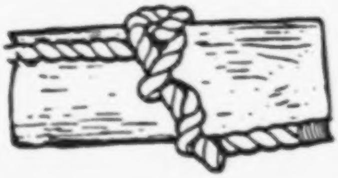


FIGURE 88

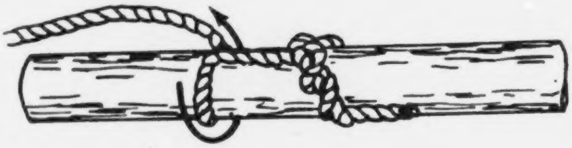


Yes No

4. Pull rope so that it is snug. ___ ___

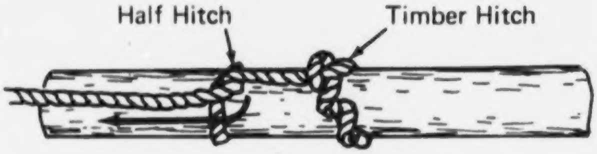
5. Pick up left end of rope, and make a loop under and around timber several inches from timber hitch. ___ ___

FIGURE 89



6. Loop this end of rope under itself, and then pull snugly to the left. ___ ___

FIGURE 90



PROCEDURE

Part 2 — Install wire rope clips

1. Turn back a length of rope beyond pointed end of thimble equal to the number of clips times clip spacing. (Figures 91 and 92) ___ ___

FIGURE 91

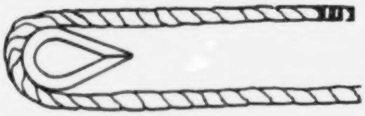
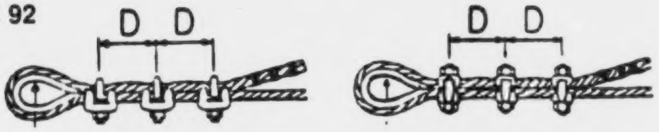


FIGURE 92



	U-BOLT CLIP		FIST GRIP CLIP	
Diameter of Wire Rope	Number of Clips for Improved Plow Steel	Minimum Spacing D between Clips	Number of Clips for Improved Plow Steel	Minimum Spacing D between Clips
Inches		Inches		Inches
3/8	3	3¼	3	3¼
1/2	4	3¾	3	3¾
5/8	4	4	3	4
3/4	5	4½	4	4½
7/8	5	5¼	4	5¼
1	5	6	5	6
1⅛	6	6¾	5	6¾
1¼	6	7½	6	7½
1⅜	7	8¼	6	8¼
1½	7	9	6	9

NOTE: Number and spacing of clips shown in table are minimum number required to develop 80% of full strength of the rope.

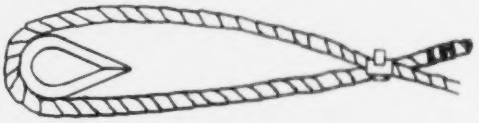
Yes No

2. Position first clip at least one clip base width from end of wire rope and be sure that the U-bolt sections of all clips are over the short or running end of the rope. ___ ___

   NOTE: Do not alternate clip positions.

Yes No

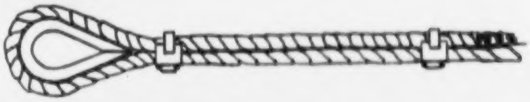
FIGURE 93



3. Tighten nuts, alternating from one to the other to obtain equal clamping action. ___ ___

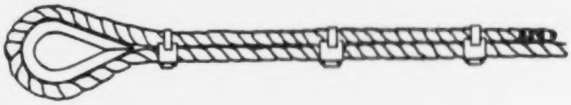
4. Position second clip next to end of thimble and tighten nuts until firm but not tight. ___ ___

FIGURE 94



5. Space the third clip equally between the first two and tighten nuts until firm. ___ ___

FIGURE 95



6. Take up any rope slack; then alternately tighten nuts on each clip until they are tight. ___ ___

7. Torque to manufacturer's specifications. ___ ___

8. Put away tools and equipment and clean work area. ___ ___

(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
Tied knots properly	4	3	2	1
Clipped spacing correctly (3¼" between clips)	4	3	2	1
Torque to manufacturer's specifications	4	3	2	1
Looped section of clip over the running end of wire rope	4	3	2	1
Time standard for a 4 rating is 10 minutes or less	4	3	2	1

EVALUATOR'S COMMENTS

605

votech

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** — Can perform job with no additional training
3 **Moderately Skilled** — Has performed job during training program; limited additional training may be required
2 **Limited Skill** — Has performed job during training program; additional training is required to develop skill
1 **Unskilled** — Is familiar with process, but is unable to perform job

JOB SHEET 2

RIGGING AND MATERIAL HANDLING

D 3

Name ______________________ Score __________

OBJECTIVE 7

Rig and handle loads using proper hand signals.

TOOLS AND MATERIALS

- Hard hat
- Wrench (to fit nuts on clips)
- Torque wrench
- 4-wire rope clips
- Slings
- Spreader bar
- Wood blocks
- Hoist
- Loads

PROCEDURE 1

Rig and handle a load where the center of gravity is not centered.

Functional Reading Skills
- Follow written instructions

Interactive Communication Skills
- Analyze/apply non-verbal communication

CAUTION: For loads that appear to be extremely heavy, the exact weight of load must be determined prior to rigging to assure that load will not exceed lifting capacity of hoist or exceed safe working load of wire rope used.

	Yes	No
1. Put on hard hat.	___	___
2. Estimate location of center of gravity.	___	___
3. Spot hook over this point.	___	___
4. Attach slings of proper strength and length from hook to lifting lugs.	___	___

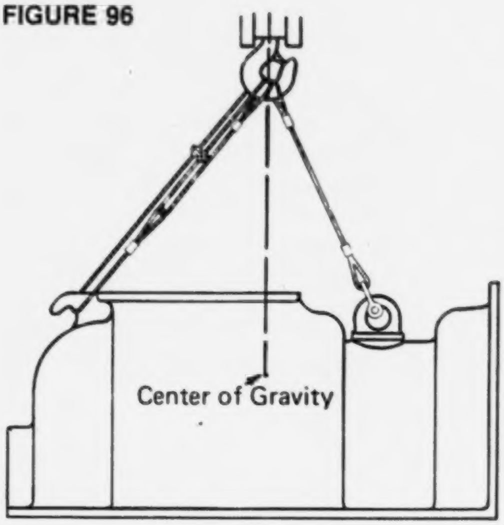
NOTE: Slings of different lengths will probably have to be used. Because they are not always available, it may be necessary to improvise.

Yes No

CAUTION: Be very careful that proper slings are used and that they are attached properly. Use wire rope only when necessary.

5. After adjusting sling to proper length, install cable clips as shown in Job Sheet 1. ___ ___

FIGURE 96



6. Give signal to hoist load slowly. ___ ___
7. Take up strain on line by lifting just a few inches off the ground to check balance of load. ___ ___
8. Give signal to stop. ___ ___
9. Give signal to lower load. ___ ___

608

Yes No

10. Give signal to stop. ___ ___

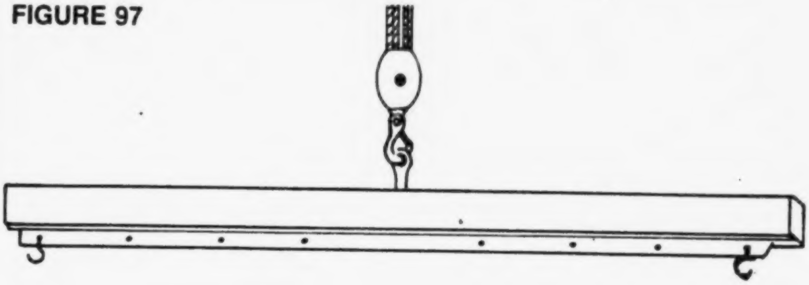
11. Disconnect slings from hoist hook. ___ ___

PROCEDURE 2

Rig and handle extra long loads. Yes No

1. Attach spreader bar to hoist hook. ___ ___

FIGURE 97



2. Center spreader bar over load. ___ ___

3. Give signal to hoist. ___ ___

4. When spreader bar is clear, give signal to stop. ___ ___

5. Give signal to swing in direction of load. ___ ___

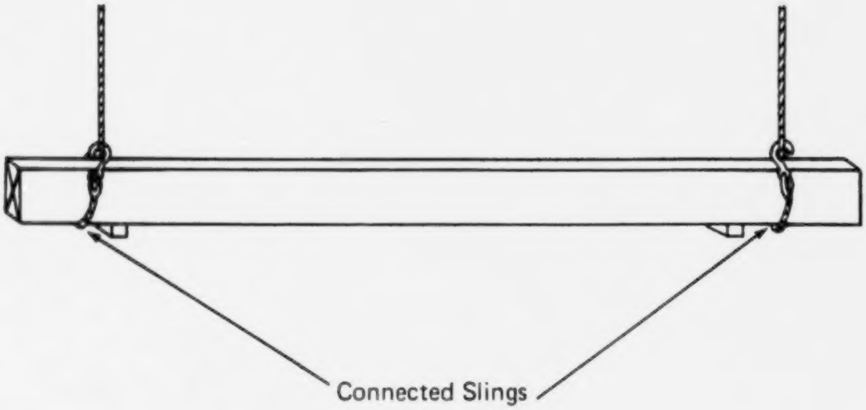
6. When spreader bar is over load, give signal to stop. ___ ___

7. Give signal to lower spreader bar. ___ ___

8. When spreader bar is low enough, give signal to stop; then connect sling to each end of load. (Figure 98) ___ ___

Yes No

FIGURE 98



NOTE: Be sure that hooks face out.

9. Give signal to hoist load slowly. ___ ___

10. Take up strain on line by lifting just a few inches off ground to check balance of load. ___ ___

Yes No

11. Give signal to stop. ___ ___

12. Give signal to lower load. ___ ___

13. Be sure load is centered over blocks and slings are clear. ___ ___

14. Give signal to stop. ___ ___

15. Disconnect slings and spreader bar from hoist hook. ___ ___

Yes No

PROCEDURE 3

Rig and handle the turning or rotating of a load.

1. Attach single sling so that the part of sling leading from hoist hook will go directly to bottom of load. ___ ___

   NOTE: Be sure hook points away from hoist.

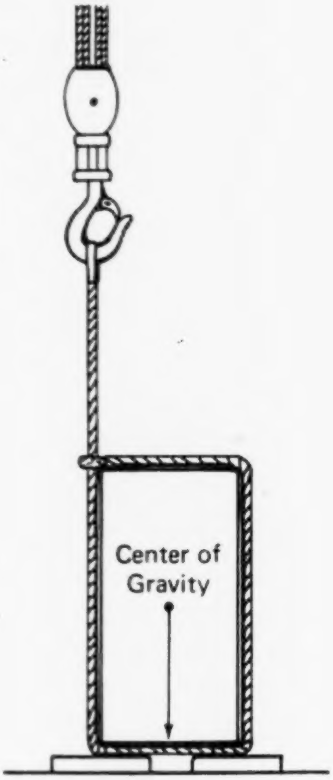
2. Give signal to lower hook. ___ ___

3. Give signal to stop. ___ ___

4. Attach sling to hoist hook. (Figure 99) ___ ___

Yes No

FIGURE 99



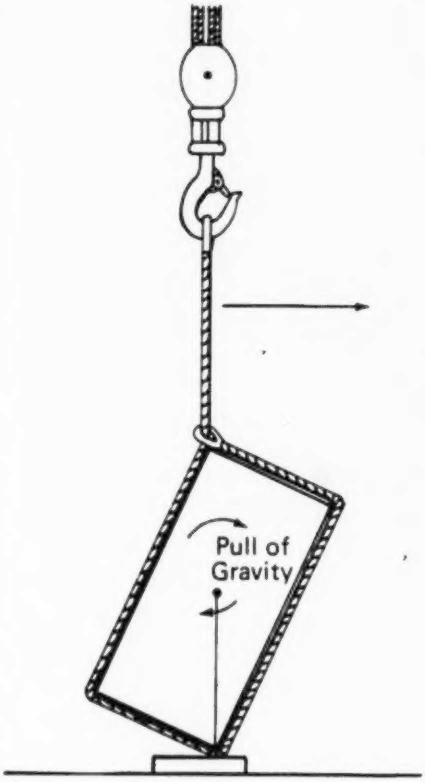
5. Give hand signal to hoist slowly and move boom so hook will move forward. ___ ___

6. When load is just clear of surface, give signal to stop hoisting. ___ ___

   NOTE: This will cause load to tilt (Figure 100).

Yes No

FIGURE 100



7. Give signal to stop movement when load is in position. ___ ___

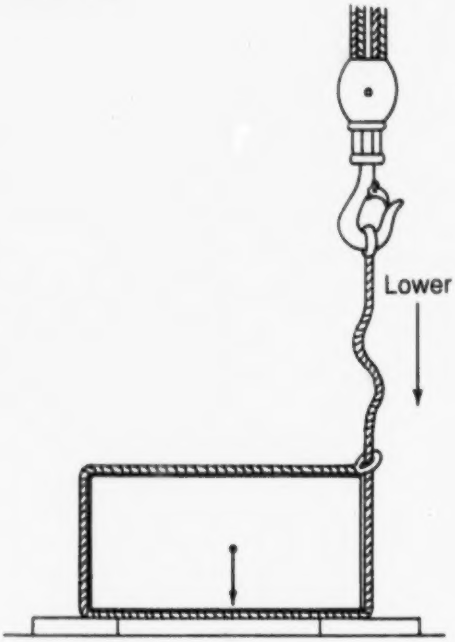
8. Move one block forward so that load will rest on it when it is lowered. ___ ___

Yes No

9. Give signal to lower load slowly and move load forward slowly. ___ ___

   NOTE: This will allow the load to rotate slowly to a flat position. (Figure 101.)

FIGURE 101



10. Give signal to stop; then give signal to dog everything. ___ ___

11. Put away tools and equipment and clean work area. ___ ___

(End of Job Sheet)

SKILL TEST RECORD

EVALUATOR'S COMMENTS

____

____

____

PRODUCT EVALUATION

Evaluator note: Rate the student on the following criteria by circling the appropriate numbers. Each criterion must receive a rating of "3" or higher to demonstrate student mastery. (See Performance Evaluation Key.) A student who is unable to demonstrate mastery should review the material and submit another product for evaluation.

Criteria:				
No shift or slip	4	3	2	1
No connection failure	4	3	2	1
Load performed as predicted	4	3	2	1
Cables not bound	4	3	2	1
No time limit identified because of safety	4	3	2	1

EVALUATOR'S COMMENTS

____

____

____

AVERAGE RATING

Evaluator note: To obtain an average rating for the Competency Profile, total the designated points in "Product Evaluation" and divide by the total number of criteria. Circle the rating on the "Performance Evaluation Key" below.

PERFORMANCE EVALUATION KEY

4 **Skilled** – Can perform job with no additional training
3 **Moderately Skilled** – Has performed job during training program; limited additional training may be required
2 **Limited Skill** – Has performed job during training program; additional training is required to develop skill
1 **Unskilled** – Is familiar with process, but is unable to perform job

616

votech

WRITTEN
TEST

RIGGING AND MATERIAL HANDLING

D 3

Name ______________________ Score ________

OBJECTIVE 1

Given a list of terms associated with rigging and material handling, match them to their correct definitions. Write the letter that corresponds to the most correct answer.

_____ 1. What is the term used to describe a rope used to guide and/or steady loads while being lifted?

a. Tagline
b. Thimble
c. Guide-line
d. Load-line

_____ 2. A hand signal used in construction to indicate someone to "secure everything" is called a

a. stop
b. pick
c. lock
d. dog

_____ 3. What is the term to describe a grooved metal ring inserted in a loop of rope to prevent wear?

a. Ringlet
b. Hitch
c. Thimble
d. Core ring

_____ 4. The process of attaching a rope to a post, pole, ring, or other object is known as

a. latching
b. tacking
c. hitching
d. splicing

May be photocopied for student use.

_____ 5. What is the term used for the assembly of blocks and lines used to gain a mechanical advantage in lifting?

a. Sling
b. Tackle
c. Accessories
d. Basket

_____ 6. The direction, length, or angle of twist of the strands of a rope or cable is called its

a. shape
b. core wrap
c. twist
d. lay

_____ 7. Which of the following terms describes that point in a body about which all the weights of the various parts balance?

a. Center of gravity
b. Load point
c. Tilt center
d. Gravity inversion

_____ 8. What is the term to describe a device used to prevent crushing the load and is also used to lift extra long and heavy loads?

a. Snatch block
b. Splicer
c. Spreader
d. Sheave

_____ 9. The activity of setting up block and tackle to a winch or stacking and hoisting material and equipment is known as

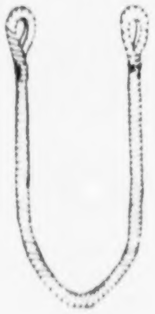
a. preforming
b. rigging
c. snatching
d. interacting

May be photocopied for student use

OBJECTIVE 2

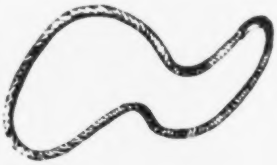
Given drawings, match load lifting accessories with their identities.

_____ 1. The drawing shown below represents a/an



a. web sling
b. basket hitch choker
c. choker hitch sling
d. inverted hitch sling

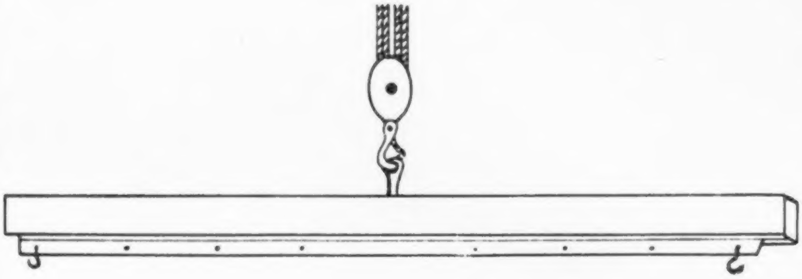
_____ 2. The load lifting device shown below is known as a/an



a. bridle
b. basket hitch
c. inverted loop hitch
d. grommet sling

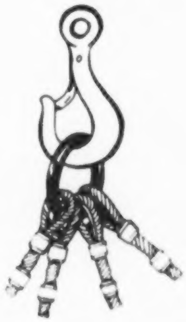
May be photocopied for student use.

_____ 3. The figure below represents a/an



a. compression bar
b. tackle wedge
c. spreader bar
d. waler bar

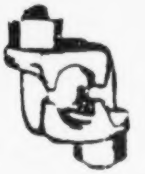
_____ 4. This figure represents a/an



a. bridle
b. hook and sling
c. spreader sling
d. tension loop

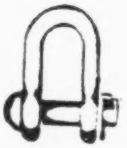
May be photocopied for student use.

_____ 5. The figure below best represents a/an



a. fist grip wire rope clip
b. U-bolt wire rope clip
c. turn buckle with spliced rope
d. safety snap hook

_____ 6. The drawing below best represents a/an



a. U-bolt wire rope clip
b. "N" wire rope adapter
c. standard shackle
d. screw pin shackle

NOTE: Objectives 3-7 are evaluated on job sheets/assignment sheets in this unit. If you have not completed these components, see your instructor.

May be photocopied for student use.

WRITTEN TEST ANSWERS

RIGGING AND MATERIAL HANDLING

D 3

OBJECTIVE 1

1. a
2. d
3. c
4. c
5. b
6. d
7. a
8. c
9. b

OBJECTIVE 2

1. b
2. d
3. c
4. a
5. a
6. c

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CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE A1 -- INDUSTRY ORIENTATION

TOTAL NUMBER OF TEST QUESTIONS 27

TOTAL NUMBER OF BASIC SKILL QUESTIONS 26

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-9	U
2	1-3	U
3	1-2	U
4	1-3	E
5	1-2	E
6	1	E
7	1	X
8	1-3	E
9	1-3	E

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE A2 – STARTING A CONSTRUCTION BUSINESS

TOTAL NUMBER OF TEST QUESTIONS 18

TOTAL NUMBER OF BASIC SKILL QUESTIONS 10

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-10	U
2	1-4	X
3	1-4	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE B1 – ORIENTATION TO SAFETY

TOTAL NUMBER OF TEST QUESTIONS 23

TOTAL NUMBER OF BASIC SKILL QUESTIONS 0

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-6	X
2	1-2	X
3	1	X
4	1-6	X
5	1-2	X
6	1-3	X
7	1	X
8	1-2	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE B2 – APPLIED CONSTRUCTION MATH

TOTAL NUMBER OF TEST QUESTIONS 10

TOTAL NUMBER OF BASIC SKILL QUESTIONS 10

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-7	M
2	1-3	M

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE C1 – MEASURING

TOTAL NUMBER OF TEST QUESTIONS 12

TOTAL NUMBER OF BASIC SKILL QUESTIONS 6

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-6	M
2	1-4	X
3	1-2	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE C2 — PLAN READING

TOTAL NUMBER OF TEST QUESTIONS 15

TOTAL NUMBER OF BASIC SKILL QUESTIONS 0

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-7	X
2	1-6	X
3	1-2	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE C3 – SITE LAYOUT

TOTAL NUMBER OF TEST QUESTIONS 15

TOTAL NUMBER OF BASIC SKILL QUESTIONS 1

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-6	X .
2	1-3	X
3	1-2	X
4	1	X
5	1	X
6	1	M
6	2	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE D1 – COMMON TOOLS AND EQUIPMENT

TOTAL NUMBER OF TEST QUESTIONS 41

TOTAL NUMBER OF BASIC SKILL QUESTIONS 0

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-8	X
2	1-8	X
3	1-4	X
4	1-10	X
5	1-2	X
6	1-7	X
7	1-2	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE D2 – LADDERS AND SCAFFOLDS

TOTAL NUMBER OF TEST QUESTIONS 21

TOTAL NUMBER OF BASIC SKILL QUESTIONS 0

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-6	X
2	1-3	X
3	1-3	X
4	1-9	X

CIMC
TEST CODE SHEET

VOCATIONAL PROGRAM (BOOK TITLE) FUNDAMENTALS OF CONSTRUCTION

UNIT NUMBER AND TITLE D3 – RIGGING AND MATERIAL HANDLING

TOTAL NUMBER OF TEST QUESTIONS 15

TOTAL NUMBER OF BASIC SKILL QUESTIONS 0

OBJECTIVE NUMBER	TEST QUESTION NUMBER(S)	BASIC SKILL CODE(S)
1	1-9	X
2	1-6	X

FUNDAMENTALS OF CONSTRUCTION

READING SKILLS

UNITS OF INSTRUCTION	Reading Comprehension									Research and Reference								Functional Reading						Language		Composit				
	Gain factual information	Distinguish fact, opinion and inference	Recognize stereotyping and bias	Recognize propaganda	Analyze cause and effect	Draw conclusions	Make generalizations	React to written material	Apply word analysis techniques	Select useful resources	Locate resources	Find materials in library	Use standard references	Use in-book reference tools	Use audiovisual media	Use computer data base	Use magazines and newspapers	Interpret forms and records	Follow written instructions	Interpret graphics and symbols	Use content area vocabulary	Interpret abbreviations/acronyms	Read aloud	Use standard grammar and correct spelling, punctuation, and capitalization	State ideas clearly	Use complete sentences	Develop preliminary outline	Use topic sentences	Use introductory/closing paragraphs	Compose reports
Industry Orientation																		●	●					●	●	●			●	
Starting a Construction Business		●									●								●											
Orientation to construction Safety						●													●	●										
Applied Construction Math																														
Measuring	●																		●	●										
Plan Reading	●																		●											
Site Layout	●																		●	●		●								
Common Tools and Equipment																			●	●										
Ladders and Scaffolds																			●											
Rigging and Material Handling																			●											

CIMC BASIC SKILLS DOCUMENTATION MA

WRITING SKILLS

mposition					Research					Functional Writing						
Use introductory/closing paragraphs	Compose reports	Compose essays	Proofread and edit	Construct graphics and symbols	Take notes	Use notecards	Create bibliography	Use footnotes	Outline material	Complete forms and records	Write instructions	Write letters	Write job applications	Write resumes	Use word processing	Use computer graphics
●			●							●		●		●		
										●						

MATH SKILLS

Operation and Calculation														Math Application											Data Analysis and Display								
Round off numbers	Estimate answers	Use scientific notations	Use exponential notations	Calculate with whole numbers	Calculate with fractions	Calculate with decimals	Convert whole numbers to fractions	Convert whole numbers to decimals	Solve numerical expressions	Solve formulae and equations	Obtain squares and square roots	Convert units of measure	Perform metric calculations	Solve word problems	Select/apply mathematical formula	Select/apply mathematical procedure	Use English and metric measures	Solve time/rate/distance problems	Solve ratio/proportion problems	Solve percent problems	Apply techniques of scaling	Apply algebra principles	Apply geometry principles	Apply trigonometry principles	Interpret charts and tables	Interpret graphs (type)	Collect /record data	Apply sampling techniques	Apply principles of probability	Construct charts and tables	Construct graphs	Calculate statistics	Interpret st
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ATRIX

SCIENCE SKILLS

94-010486

ls			Functional Math														General Science									Life Science							Physical Science					Earth Science							
Calculate statistics	Interpret statistics	Interpret blueprints/plans	Make measurements	Perform banking transactions	Make change	Solve practical problems	Calculate gross earnings	Solve income/expense problems	Prepare a budget	Calculate interest	Solve interest problems	Calculate sales tax	Determine income tax	Use calculator for computation	Use computer for computation	Use computer spreadsheets	Apply computing skills	Apply scientific method of inquiry	Conduct experiments	Investigate science ethics	Investigate science history	Investigate/apply economics in technology	Use scientific instruments	Investigate/apply technology	Collect specimens	Identify/classify living organisms	Investigate biological history of the earth	Investigate food chains, webs, pyramids	Investigate/apply principles of human development	Investigate/apply principles of genetics/heredity	Investigate/apply principles of anatomy/physiology	Investigate health issues	Analyze/classify matter	Investigate forms/changes of matter	Investigate forms/changes of energy	Investigate/apply chemical properties	Investigate/apply physical laws	Investigate physical characteristics of the earth	Investigate geological history of the earth	Investigate physical forces acting on the earth	Solve problems of longitude, latitude, and time zones	Investigate conservation of physical resources	Investigate conservation of living resources	Investigate issues of environmental impact	Apply science principles to environmental
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	ORAL COMMUNICATION SKILLS																							IN										
	Oral Presentation									Listening				Interactive Communication										General Relating										
UNITS OF INSTRUCTION	Make informative presentations	Make persuasive presentations	Present personal opinion/viewpoint	Use good speaking techniques	Select/use words effectively	Use effective body language	Present appropriate appearance	Integrate audio and/or visual materials in oral presentations	Adapt presentation to specific audience	Apply active listening skills	Distinguish fact, opinion, and inference	Draw conclusions/make generalizations	Analyze/identify point of view	Give/follow oral directions	Apply questioning techniques	Conduct/receive interviews	Analyze/apply nonverbal communication	Work effectively in a group	Communicate with clients/customers/patients	Communicate with co-workers	Communicate with supervisors	Communicate with professional colleagues/associates	Apply telephone etiquette	Investigate/apply communication process models	Analyze/apply nonverbal communication	Investigate/apply cross-cultural communication	Interact with co-workers	Interact with supervisors	Interact with clients/customers/patients	Interact with professional/colleagues/associates	Interact with family/friends	Participate in group activities	Participate in industrial relations/functions	Identify personal values/attitudes
Industry Orientation				●	●					●												●												
Starting a Construction Business																														●					
Orientation to construction Safety																																		
Applied Construction Math																																		
Measuring																																		
Plan Reading																																		
Site Layout																																		
Common Tools and Equipment																																		
Ladders and Scaffolds																						●												
Rigging and Material Handling																		●																
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INTERPERSONAL OR RELATING SKILLS																								CREATIVE THINKING/ PROBLEM SOLVING SKILLS																				EM						
Teamwork/ Cooperation																	Leadership/ Influence							Cognitive Activities																				Job Search/ Selection						
Identify personal values/attitudes	Apply information to life experiences	Identify values/attitudes	Identify needs/drives	Select/apply appropriate behavior	Investigate/identify personal styles	Investigate/identify group/corporate climate	Give/receive feedback	Identify hidden purposes	Investigate/apply group dynamics	Control undesirable/inappropriate behavior	Resolve conflicts	Clarify goals/objectives	Devise "win/win" situations	Build consensus	Generate ideas	Present point of view	Analyze/apply leadership styles	Analyze/apply management styles	Obtain confidence of others	Develop esteem in self/others	Persuade others	Analyze/apply motivation techniques	Provide positive coaching	Collect/record information	Identify critical elements/issues	Define a problem	Identify underlying causes	Apply a problem-solving model	Analyze/synthesize information	Identify/analyze underlying assumptions	Draw conclusions	Predict results/outcomes	Identify/evaluate consequences	Identify/develop alternatives	Evaluate alternatives	Select an alternative	Devise a solution	Create a finished product	Apply intuitive/creative thinking processes	Transfer knowledge/training to new situations	Apply new technology	Develop an action plan	Evaluate results/outcomes	Analyze personal occupational aptitudes/preferences	Investigate employment prospects of a career field/occupation	Investigate training requirements for a career field/occupation	Investigate benefits of a career field/occupation	Compare/evaluate career options	Develop personal career path	Locate appropriate jobs
																								●	●				●		●													●	●			●		●
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MPLOYABILITY SKILLS

SOCIAL STUDIES SKILLS

			Job Aquisition/ Development														Information Analysis						Social Studies Application										Functional Social Studies														
Develop personal career path	Locate appropriate jobs	Analyze duties/requirements/benefits of specific job	Master specific job task/procedure	Fill in job-related applications	Write letter of application	Write personal resume	Interview for a job	Apply business etiquette	Practice good work habits/attitudes	Develop good personal presentation	Develop self-confidence/esteem	Develop effective leadership	Deal effectively with supervisors	Deal effectively with co-workers	Deal effectively with professional colleagues/associates	Deal effectively with customers/clients	Collect/record data	Interpret graphical information	Construct graphical information	Interpret maps/globes	Interpret statistical information	Analyze/interpret demographic information	Investigate/apply U.S. history	Investigate/apply world history	Investigate/apply U.S. geography	Investigate/apply world geography	Investigate/apply principles of government/politics	Investigate/apply principles of economics	Investigate/apply principles of ethics	Investigate/apply principles of psychology	Investigate/apply principles of sociology	Investigate/apply cross-cultural studies	Practice responsible personal economics	Prepare a personal budget	Use credit responsibly	Practice good work ethics	Participate in industrial relations	Interact with people of different races/cultures	Investigate/participate in government	Investigate/apply American legal practices	Select/use sources of information on current events	Analyze current events	Analyze consumer issues	Analyze social issues	Analyze conservation/ecology issues	Analyze social impact of science/technology	Analyze economic impact of science/technology
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Date Filmed
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(9/92)